

# Website Development

6

## Getting to know your unit

### Assessment

You will be assessed by a series of assignments set by your tutor.

The internet has grown and developed so much within the last decade, enabling new ways of communicating and sharing information. It has transformed the way in which people use information technology. Millions of web pages are created daily so it is important that they are engaging and capture the interest of the public. Website developers need to understand how to resolve complex problems and develop innovative solutions.

The evolution of the worldwide web has brought about more exciting opportunities for businesses and individuals. Businesses can now sell goods and services online, which extends their customer base, potentially worldwide. Individuals can communicate with people anywhere in the world cheaply and affordably. The worldwide web also caters for individuals who have physical disabilities. For example, a person with a visual impairment can browse the web using new accessibility tools.

As the worldwide web evolves, information technology professionals must evolve with it. In this unit you will learn the fundamental principles and key concepts of website design and development. The skills you acquire will benefit you if you wish to further your studies in higher education or prepare for employment in the website development sector.

### How you will be assessed

This unit will be assessed by a series of internally assessed tasks set by your tutor. Throughout this unit, you will find activities that will help you work towards your assessment. Completing these activities will not mean that you have achieved a particular grade, but you will have carried out useful research and preparation that will be relevant when it comes to your final assignment.

In order to complete the tasks in your assignment successfully, it is important to check that you have met all the Pass grading criteria. You can do this as you work your way through the assignment.

If you are hoping to gain a Merit or Distinction, you should make sure that you present the information in your assignment in the required style. For example, Merit criteria require you to analyse and discuss, and Distinction criteria require you to assess and evaluate.

The assignment set by your tutor will consist of a number of tasks designed to meet the criteria in the table. This is likely to consist of a written assignment but may also include activities such as the following.

- ▶ Explaining how websites are used and the principles that underpin them.
- ▶ Using different design techniques to provide innovative solutions to complex problems.
- ▶ Creating a website based upon your design documentation.

**Assessment criteria**

This table shows what you must do in order to achieve a **Pass**, **Merit** or **Distinction** grade, and where you can find activities to help you.

<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
<b>Learning aim A</b> Understand the principles of website development		
<b>A.P1</b> Compare the principles of website design used in two websites, including their suitability for the intended audience and intended purpose.  <b>Assessment practice 8.1</b>	<b>A.M1</b> Analyse how the principles of website design are used to produce creative, high performance websites which meet client requirements.  <b>Assessment practice 8.1</b>	<b>A.D1</b> Evaluate how the principles of website design are used to produce creative, high performance websites which meet client requirements.  <b>Assessment practice 8.1</b>
<b>Learning aim B</b> Design a website to meet client requirements		
<b>B.P1</b> Produce designs for a website that meets client requirements.  <b>Assessment practice 8.2</b>	<b>B.M2</b> Justify the design decisions, explaining how they will meet the users' needs and be fit for purpose.  <b>Assessment practice 8.2</b>	
<b>B.P3</b> Review the website design proposals with others to identify and inform improvements.  <b>Assessment practice 8.2</b>		
<b>Learning aim C</b> Develop a website to meet a client requirement		
<b>C.P4</b> Produce a website for an intended audience and purpose.  <b>Assessment practice 8.2</b>	<b>C.M3</b> Optimise a website to meet client requirements.  <b>Assessment practice 8.2</b>	<b>BC.D2</b> Evaluate the design and optimised website against client requirements.  <b>Assessment practice 8.2</b>
<b>C.P5</b> Test the website for functionality, compatibility and usability.  <b>Assessment practice 8.2</b>		<b>BC.D3</b> Demonstrate individual responsibility, creativity and effective self-management in the design, development and review of a website.  <b>Assessment practice 8.2</b>
<b>C.P6</b> Review the extent to which the website meets client requirements.  <b>Assessment practice 8.2</b>		

## Getting started

Think about some of your favourite websites. What is it about them that makes them your favourite? Is it the colour, the positioning of elements, or the font type used? Working in small groups, list some of your favourite websites and note down what you think it is that makes them stand out from the rest.



### A

## Understand the principles of website development

Websites have changed tremendously throughout the years. When the web was first developed, it was used by scientists in research institutes to share ideas. Early websites included **hypertext** and hyperlinks as a way of moving through all the text. In today's world, websites are still used to share ideas, but the web has evolved into something essential to our way of life.

### Key term

**Hypertext** - text that contains links to other bits of text.

### Theory into practice

In this unit you will come across many technical terms. Go online and develop your own wiki that will serve as a glossary for all the terms you come across within this unit. This can be shared with your class and you could all contribute to it.

## Purpose and principles of website products

Websites are now so much more than simple links that provide information. Consider a very basic news website. It is full of up-to-date content such as videos for streaming, polls where visitors can publish their thoughts, and even basic games. Websites and the businesses that run them are now in competition against one another to get you to view their products. Therefore, website developers need to understand the purpose and principles of website design so that they can make websites which are fit for purpose but also stand out in people's minds for the right reasons.

### Purpose of websites

Websites have different purposes and perform different functions. Traditionally, websites were used to provide information. However, content based technology called Web 2.0 has been developed to enable users to interact and add their own content, knowledge and opinions. Web 2.0 technology has enabled the development of the following:

- ▶ **Wikis** – places where all users can contribute to information, the biggest example of which is Wikipedia, an encyclopaedia website where anyone can contribute to any article and even create new ones.

- ▶ **Blogs** – online journals that include tools for readers to comment and contribute. Anyone can become a blogger and create a blog, most of which are public (although there are some private ones).
- ▶ **Social networking** – websites such as Facebook™, LinkedIn™ and Twitter™ that allow people to communicate by creating a profile. These social media websites provide tools that enable users to correspond by posting status updates or tweets. They can also have private conversations and play games. Users are encouraged to make 'friends' with other users, although most people using Facebook™ are friends with people they know in real life and friends of friends online. On Twitter™, you follow celebrities and well-known figures as well as friends, but the celebrities are unlikely to follow you. There are other social media websites that offer more specific services, such as Flickr™, which allow users to share and rate photographs.
- ▶ **Online applications** – online applications allow users to use programs via the internet, rather than purchasing a program and installing it on a local computer. This means that the applications are accessible anywhere and are often free or have a small subscription fee. Google Docs™ is a good example of an online application.
- ▶ **Podcasting** – a way of making audio or video files available on the internet that can either be listened to or viewed. A podcast is saved to either a PC or a mobile device where a user can listen to or view the content while they are on the move. A podcast will be treated as a sound file (audio podcasts) or a film (video podcasts are also known as vodcasts).

## Product and/or service-based websites

► Table 6.1: Examples of product and/or service-based websites

Service	Example types	Target audience	Key benefits
Commerce	<ul style="list-style-type: none"> <li>▪ eBay™</li> <li>▪ Amazon™</li> <li>▪ online banking</li> </ul>	<ul style="list-style-type: none"> <li>▪ consumers</li> </ul>	Allows users to carry out transactions easily and conveniently on PCs and mobile devices.
Real-time information	<ul style="list-style-type: none"> <li>▪ 24/7 news updates</li> <li>▪ travel information</li> <li>▪ weather reports</li> </ul>	<ul style="list-style-type: none"> <li>▪ information seekers</li> </ul>	Provides immediate up-to-date information. For example, mobile phone apps can send notifications to inform you of recent news reports or train arrival times.
Communication	<ul style="list-style-type: none"> <li>▪ blogs</li> <li>▪ Skype™</li> <li>▪ email</li> <li>▪ online gaming</li> </ul>	<ul style="list-style-type: none"> <li>▪ social networkers</li> <li>▪ information seekers</li> <li>▪ online gamers</li> <li>▪ adult and teenage consumers</li> </ul>	You can receive immediate replies from anyone at no additional cost to your broadband or mobile fee.
Download services	<ul style="list-style-type: none"> <li>▪ music downloads</li> <li>▪ film downloads</li> <li>▪ software downloads</li> <li>▪ gaming downloads</li> <li>▪ streaming services</li> </ul>	<ul style="list-style-type: none"> <li>▪ information seekers</li> <li>▪ entertainment seekers</li> <li>▪ online gamers</li> <li>▪ adult and teenage consumers</li> </ul>	Flexibility and convenience of downloading different mediums to your PC or mobile device. Moreover, you can also now stream online content to your television, computer or mobile device.
Virtual learning environments (VLEs)	<ul style="list-style-type: none"> <li>▪ Moodle</li> <li>▪ Pearson's ActiveLearn Digital Service</li> <li>▪ Blackboard™</li> </ul>	<ul style="list-style-type: none"> <li>▪ information seekers</li> <li>▪ consumers (teachers and learners)</li> </ul>	Many benefits as learners have the flexibility of downloading information from the comfort of their own home. Moreover, learners can submit homework/assignments online or be set independent study tasks.

## Requirements of websites

### Discussion

Hackers have caused controversy by being able to hack into personal data stored on websites and then release the information to the public over the Internet. This has included credit card details. In small groups, consider the benefits and risks of buying products and services online.

The following are key requirements of all websites.

- User-friendly - It is easy to use and understand. Understanding how to produce a user-friendly website will significantly improve the way in which visitors are able to understand and use your website in terms of layout, design and the content.
- Consistent - Consistency, that is, keeping things the same, is a key principle of website design. Consistency can apply to many different things within website design. For example, consistency in the colours and font typography you use, the positioning of links on pages and the style and images you use. An inconsistent approach to website design makes for a website that will ultimately frustrate users. Consistency makes for an intuitive and user-friendly website.
- Navigational - It is important that any website you develop is easy for users to navigate and find the information that they require. Think of a website's navigation like a road

map to all the different areas and information contained within the website. A consistent navigation system will help your users to find the information they require more quickly. It is also important not to add in unnecessary levels of navigation.

- Customisable - New technologies have made it possible to customise website interfaces for website users. The benefit of this is that you can attract new users and keep existing users more engaged with your website. For example, consider the way in which some websites allow you to set your location on them. One advantage of doing this is that you can get regular news headlines about your specific area or receive local weather reports.
- Responsive - Responsive websites are those that are optimised to automatically adapt to the layout of the web browser you are using, whether on a PC or mobile device, without the need to resize or scroll excessively.
- Bandwidth utilisation - With many on sensitive data mobile contracts, designers must recognise how their content will be used and how many will view the viability of the service that they offer.

### Research

Carry out some research into quantum computing. What implications will quantum computing have for the way we buy and sell products and services online?

## Principles of website design

Millions of websites are built on a daily basis, so more emphasis is now given to the principles of good website design. Following these standard principles is important as it allows every website the opportunity to be successful in a market which is very competitive. When you combine these principles of good design with elements of innovation and creativity, your website has every chance of being successful. In terms of business, if you get the website right, the business is more likely to succeed.

- ▶ **Usability** - This is the ease of use of a website, that is, how user-friendly it is. For example, an important element of website usability is ensuring that website content is flexible and works on all browsers and devices.
- ▶ **White space/spacing** - This is the space on web pages that is left untouched and white. Website developers utilise white space to separate design elements such as text, graphics and other elements. Unless you utilise spacing, your web pages will look cluttered and messy, and it would be hard for visitors to interpret which words relate to which images and understand what they are looking at. Therefore, when designing a web page, it is crucial to use spacing between elements so as not to overwhelm and confuse website users.
- ▶ **Site layout** - This means giving consideration to where elements go on a web page and how content will be spread across a website. For example, where the header, navigation links, text and graphics will appear on the page. The layout used for one web page should be consistently used across all the pages on a website, where similar content is being included. For example, headers should be positioned in the same way on all pages. A good site layout is one that is uncomplicated, has clear navigation and is intuitive and user-friendly.
- ▶ **Accessibility** - Website developers must ensure that websites are correctly designed and developed to enable all users to have equal access to information. This is important as it removes barriers that would otherwise prevent a person with disabilities from using a website. The BBC is an example of a website that provides excellent website accessibility. It includes features that advise users on how to customise their computer set-up and remove barriers to using the website. People with poor vision can change the font size and colour. In addition, it provides accessible games for children with motor and cognitive disabilities. **Alexa Traffic Rank** consistently rates the BBC website in the top 100 websites worldwide. One reason for this is the excellent way that it caters for all users.

## Key terms

**Alexa Traffic Rank** - ranks websites based on a combined measure of page views and the number of visitors. From this, it creates a list of 'top websites' averaged over three-month periods.

**Serif** - a type of font that has embellishments at the ends of letters. An example of a serif font is Times New Roman.

**Sans serif** - The word 'sans' is French meaning, 'without'. Therefore a sans serif font is one without embellishments at the ends of the letters. An example of a sans serif font is Arial.

## Link

The World Wide Web Consortium is committed to ensuring that the web is accessible for all, regardless of their disability. Find out more about their Web Accessibility Initiative at [www.w3.org/WAI/](http://www.w3.org/WAI/)

- ▶ **Navigation** - It is important that users can navigate their way easily around a website. The navigation must be intuitive and simple to use. Good navigation on websites involves making it obvious where website links are and being consistent across the whole website. There should be an intuitive structure of pages.
- ▶ **Typography** - The type of font used on websites is important. Websites need to have clear and legible text in order to be user-friendly and accessible. There are two main types of font families: **serif** and **sans serif**. Most websites utilise a sans serif font such as Arial because they have no embellishments to the letters, making them clearer and easier to read.

## Research

Research how typography is connected to disabilities such as dyslexia. When building a website, what font would you use and why? Consider what else you could do as a website developer to ensure that all users can access your website regardless of disability.

- ▶ **Alignment** - Alignment is how elements are positioned on a web page and how they interact with each other. For example, if you place an image on a web page which is aligned to the left and the supporting text was aligned to the right of the page, this would suggest to users that there is no relationship between the two elements, whereas, if they were both aligned left, there would appear to be a connection between the two elements.

- ▶ Clarity - Clarity, being clear, is key to good website design. It is pointless choosing a visually appealing design if users cannot understand it because it is not clear. Therefore, any website you develop must communicate what you want it to say clearly, but also have clarity of design and layout. For example, if you want a user to contact you, you should provide a visible email address or phone number. Asking users to fill in forms takes additional time and does not put the user first. Good design matters, but good communication matters more.
- ▶ Consistency - Consistency means keeping elements within your website the same throughout. This is considered one of the most important principles in website design. Website consistency involves using the same page layout, the same font and the same design and colour scheme, throughout. An inconsistent website is unintuitive and difficult to navigate.
- ▶ Accuracy - Everything included in the website needs to be accurate; that is, it should be correct and meaningful. To keep information accurate and current, websites should be updated regularly. Moreover, it is important that the information provided on websites is checked for factual errors as well as spelling and grammatical mistakes.
- ▶ Content - The content of the website includes the text, graphics (diagrams, artworks and photos) as well

as media and objects. Content needs to be accurate, consistent in style (where appropriate), and you need to ensure that you have permission to use any content that you did not create from scratch.

- ▶ Media and objects - Some websites include interactive content, such as videos, background sounds, Flash images and applets. Media elements are used to captivate and grab the attention of website users. The use of media must be appropriate as its overuse can slow down a website, clutter the appearance of web pages and put off some users.

#### Key term

**Applet** - a mini software application that can be built into a web page, for example a calculator that can be used by website users upon clicking a button on a web page

- ▶ Simplicity - Websites which are simplistic in their design are often the most visited. They manage to combine the content they need to get across with a clear and simple, easy-to-use design that attracts users back because they know they will get what they need from it without fuss. It is important when developing a website that you do not overcomplicate the design by introducing too many elements on the pages.



▶ Figure 6.1: Google.com home page

## II PAUSE POINT

Alexa Traffic Rank ranks websites based on a combined measure of page views and the number of visitors. In August 2015, Google.com (see Figure 6.1) was measured to be the most heavily visited website during that year. Consider what makes this website so appealing and popular. Print out screenshots(s) of Google.com and annotate them in terms of how the principles of good website design apply to this website. Alternatively, if you do not wish to use Google.com, consider another website that you think is good and identify where the principles are applied.

### Hint

Use the snipping tool within Windows (go to the Windows menu, All apps, Windows accessories, Snipping tool) to 'snip' parts of the website that adopt a principle of good website design. This is easier than printing screenshots and then cropping images.

### Extend

Consider additional principles of good website design that you believe are important. Explain what these principles are together with an annotated image to explain your reasoning.

## Media and objects

Media and objects are used within websites to draw in and engage website users. As mentioned above, media includes videos, audio and interactive content. Moreover, objects such as applets, PDFs and Flash can be embedded into web pages. There are a number of factors you should consider when using media and objects.

- ▶ Position - Where should you put media or objects on a web page? As media and objects are used to grab the attention of users, they need to be placed somewhere where they can easily be seen, but you need to consider how prominently you want to position them.
- ▶ Colour - Colour is an integral part of website design, especially when you are embedding object elements such as Flash. Flash is a form of animation used to attract the attention of users. However, too many vibrant colours can be off-putting to users. You should also consider users who suffer from photosensitivity. Therefore, when using colours you should use them appropriately so that they are not overwhelming.
- ▶ Contrast - Contrast is used to differentiate between two or more elements on a web page. For example, if you were using a Flash image embedded in your web page, and the background used a key colour of the Flash image, it would be difficult for the user to see the Flash image clearly. Therefore you should use contrasting colours to differentiate the elements of a web page.
- ▶ Size - Screen size is a big concern when developing a web page. Media and objects are used to capture the attention of users. However, if you embed a video on the web page that takes up most of the screen, this will have implications on where the rest of your content will go, and users will have to scroll to see it. Therefore, sizing of media and object elements is important, and

this should be thought through during the design phase. You will need to consider how the object will appear on a mobile. Will it work on a mobile?

- ▶ Appropriateness - When using media and objects, you must consider whether they really add anything to the effectiveness of your webpage. Although media and objects are useful to draw users' attention, the downside is that the inclusion of media and objects means that your web pages will take longer to load, especially on a mobile and they might not be compatible with every browser. Therefore, you have to consider the appropriateness of using media and objects, and whether their inclusion will actually be beneficial to website users.

### Tip

Professionalism is a key attribute not only for website developers but in any walk of life or job. One important aspect of professionalism is having good etiquette. Etiquette is a code of behaviour that dictates how we should behave within society and at work. It all comes down to manners, that is, how we behave and present ourselves. It is crucial to be professional and have good etiquette when seeking employment.

## Creativity and innovation

With so many websites being developed on a daily basis, and businesses now heavily reliant on websites, it has become very important that websites are creative and innovative if they want to draw in customers. However, websites should not be different just for the sake of being different. Website developers must have a creative side and deliver interesting designs that capture the imagination of

users, while still adhering to the principles of good website design. However, there are techniques and certain layouts which can be used to make a website 'stand out' while still conveying information in an appropriate way.

### Unconventional layouts

In the past most websites tended to fit to a standard layout template, which, to an extent, is fine because then they all follow the principles of good website design. However, there still needs to be room for creativity and innovation. A vast number of websites are being created so new websites need to stand out. The art of website design is still evolving and good, new ideas can still be found. Recently, there has been an increase in unconventional website layouts through 'out-of-the-box' thinking on the part of the website developers who came up with them.

Here are some examples of creative and innovative websites.

#### Ice & Sky

Go to [education.iceandsky.com](http://education.iceandsky.com). The Ice & Sky website follows in the footsteps of Luc Jacquet and the Wild-Touch project. What makes this website creative and innovative is that it uses unique animations to help tell the story, combined with an out-of-the-box-thinking layout. Notice how the links appear at the bottom and the main link 'Discover' is prominently displayed in the middle of the web page.

#### Link

To find out about Luc Jacquet and the Wild-Touch and Ice & Sky projects put these terms into a search engine.

### p2 Media

#### Discussion

The internet and paper-based documents are both good sources of information. What other sources can you identify? How reliable are these sources?

Now go to the p2 Media website at [www.p2media.de/](http://www.p2media.de/). This website makes good use of space by having scrolling pages for the different links within the website. In essence, it uses several home pages and scrolls through each one on a timer. This is an interesting way to present a website and is quite unconventional compared with most websites that you may come across.

#### Golden ratio

It is not known who discovered the golden ratio, but it is a mathematical concept that has been used for over 2000 years. This ratio has, either intentionally or unintentionally,

been used to make designs aesthetically pleasing. The golden ratio has been used in:

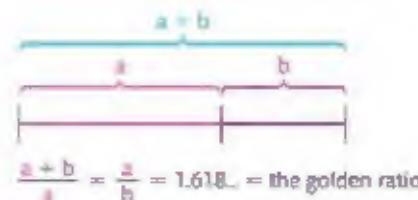
- ▶ nature
- ▶ science, including astronomy
- ▶ art, including painting
- ▶ architecture

The golden ratio can also be applied to website design. This ratio is based on a simple mathematical equation which produces a **ratio**. It produces a special number which is equal to 1.618 (or 1.62 rounded up to two significant figures). This special number is found by dividing a line into two sections so that the longer section divided by the smaller section is also equal to the whole length divided by the longer part:  $a/b = (a+b)/a$  or for example  $31/24 = (31+24)/31$ . This number of 1.62 (2sf) can be applied to web design to set the width of the main content and side bar columns.

#### Key terms

**Aesthetically pleasing** – something which is visually engaging or appealing to the senses of sight and hearing. Usually such things are considered beautiful or attractive.

**Ratio** – a way of concisely showing the relationship between two quantities. A ratio is represented by separating the two quantities with a colon (:). For example, a ratio of 1:2 is one quantity compared with something which is twice the first amount (twice as much).



► Figure 6.2: The golden ratio.

Two quantities are in the golden ratio (see Figure 6.2) if the ratio of the values is the same as the ratio of their sum to the larger of the two quantities. It is often symbolised using phi ( $\phi$ ), after the 21st letter of the Greek alphabet.

#### Research

Find examples of where the golden ratio of 1.62 appears within science (including astronomy), art (including painting), architecture and nature.

## Search engine optimisation

Search engine optimisation (SEO) is a set of techniques used to maximise the number of visitors to a website. By applying the techniques of SEO, a website developer can ensure that their website appears high on the list of results returned by a search engine for related search terms. SEO is very important to businesses as users of search engines tend to click on the first relevant link they come to. By appearing at the top of a search engine, they are likely to maximise the potential of advertising their products and services. There are books and courses available that can help you optimise your website so that it appears first on search engine results lists, although achieving this is not always as easy as it may at first appear. Outlined here are a number of the techniques that website developers use to optimise their websites for search engines. Remember that Google down-grades non-mobile-friendly sites.

### Indexing (meta tags)

Search engines use the entered search term/phrase to find websites in its database which include that term/phrase, rather than searching the whole internet each time. Search engines utilise 'spiders' to trawl the internet for new websites to include in their databases, with the intention that all websites will be included in the databases. The spiders examine each web page that they encounter and send information about that page back to the search engine to be stored in its database. This process is called 'web crawling'. There can be disadvantages to web crawling, because sometimes a web crawler will attempt to spider your website aggressively, which will result in a server overload. Therefore only limited crawling should be carried out.

To ensure that the spiders list a website correctly, website developers include meta tags in the coding of a web page. Meta tags are embedded into the `<head>` section of a web page. These meta tags are used to provide search engines with information about a website. The text in these tags is not displayed within the web page. Instead, it tells search engines (and other web services) specific information about the page. Although the meta tags are not displayed on your website, it is sensible for them to be the same as your web page headings (assuming that these are sensibly titled) to tell people what the purpose of your website is and what products or services you offer.

### Keywords

A keyword is a word or phrase that can be put into a search engine so that it will return matching and relevant results. Businesses often use market research companies to see what keywords or phrases best reflect their business, products and services. You should bear the following goals in mind when selecting keywords:

- ▶ use keywords that accurately describe the business, products or services
- ▶ use words/phrases that people actually type into search engines when looking for something online
- ▶ use the most relevant keywords in the URLs and web page titles and to describe the site; for example, you should use the keywords in the meta tags, the titles and body of the text on the pages and even in the image filenames.

### Key term

`<head>` - an HTML tag which is used to provide data about an HTML document (web page).

All this, when used correctly, can help to improve your ranking on the search results page.

### Link

For more on keywords and SEO generally, see Unit 3: *Using Social Media in Business*.

### Importance of updates

In order to ensure that your website is relevant, it must be updated regularly. Search engines can determine how often your website is updated. If a website is updated regularly, then the search engine considers it a consistent source of new information. As a result, the website is more likely to be placed higher in the search results.

## Factors affecting website performance

There are a number of different factors that affect the performance of a website. If performance is adversely affected, websites can load slowly or fail to load completely. If your website does not respond quickly, you are likely to lose users to more responsive websites. Performance is key to the success of a website.

### Where scripting runs

Scripting can either run on the web server (server-side scripts) or on the local client machine (client-side scripts). Server-side scripting is used for advanced interactive features such as connecting to a database. It works by the user requesting a web page from the server. The script in the page is interpreted by the server to suit the needs of the user, and then is sent to the device. The downside of server-side scripting is that, when a user makes requests over the network to the server, it can slow down the experience for the user and place more load (strain) on the server.

Client-side scripting is when the script is executed on the user's computer and does not connect to a server. Client-side scripting is useful as it can provide extra interactivity within web pages without the need to connect to a web server.

## Browser compliance

All web browsers were not created equally. Each web browser will render code differently. This means that when the code of your website is loaded within a web browser it can be interpreted in a different way by that web browser to the way it would be interpreted by another web browser. For example, how your website looks in Firefox® may not be how it looks in Internet Explorer®. Some pages will load faster than others depending on which web browser you use. In addition, some elements of web pages may not be supported, depending on which web browser you use. As a website developer you may be asked to develop a website which is compliant for two or three web browsers. Your job would therefore be to develop a website that appears consistently in all of these web browsers. Different web browsers also have their own advantages and disadvantages. For example, Chrome™ is good for HTML5 support, whereas Firefox® is good for its website developer add-on options. It is important to realise that when using a web browser there is not necessarily an even playing field, each one is different and unique in its own way.

## Server-side factors

Some of the factors affecting the performance of websites are server-side, that is, they relate to the capabilities and capacity of the web server being used and whether it has been bought or is rented.

- ▶ Bandwidth availability - This determines how much traffic can be handled by the web server specifically how much content can be downloaded at any one time. Bandwidth can be thought of as a pipe from the web server to the users. The bigger the pipe the more that can be sent down it. Conversely, the larger the content to go down the pipe the fewer hits of content that can go down it at any one time. The larger the web page and its associated files, the less users can download from it at any one time.
- ▶ File types - By using smaller file types which use **compression** methods the website will have a faster download time. When deciding on which file types to use a website developer must make a judgement in order to balance quality and file size, because the higher the quality, the larger the file size.
- ▶ Number of hits - The number of web page hits can have an effect on web page performance. For example, if too many people are on the same web page at the same time then it can overload the web server and slow down the website's performance.

### Key term

**Compression** - where a mathematical calculation is performed on a file in order to 'squash' it and make it smaller.

## Client-side factors

Some of the factors affecting the performance of websites are client-side, that is, they relate to the capabilities of the user's computer system. If the capabilities of the user's system are poor, those people using that system might not be able to access certain websites, particularly those that suffer from poor server-side performance.

- ▶ Upload and download speeds - The speed of the user's internet connection will determine how quickly they are able to download or upload web pages.
- ▶ Processor speed - As the connection speed will determine the rate of download so the computer's components will affect the speed with which the content is displayed and with which users can interact with it. You must take into consideration that a user's device may not have a fast processor or large memory capacity and so website developers must decide between high user specification requirements and a high number of visitors. Sites that rely heavily on client-side scripting such as JavaScript can put a significant load on a user's CPU.

► Table 6.2: Connection types with descriptions

Categories	Connection Method	Description	Typical Speed
Fixed-line narrowband	Dial-up	This was the traditional method of connection. It uses the existing analogue telephone lines and remained popular for many years. However, in 2013 BT turned off dial-up internet access service in favour of broadband.	56 kbps
	ISDN (integrated services digital network)	ISDN was used to generate faster speeds than dial-up. It still uses a phone line to which digital lines needed to be connected. However, it's slowly being phased out for much faster connection methods.	28 kbps
Fixed-line broadband	DSL (digital subscriber line)	Using digital lines, DSL was introduced. This is the most common method to provide a broadband service. The most common in the UK is ADSL (asynchronous digital subscriber line).	Mbps to 8 Mbps
	Broadband	This technology is constantly being developed and faster speeds are conceivable in the near future.	Up to 100Mbps in England
	Fibre optics	This connection method uses visible light as a transmission method. This is significantly more efficient and reliable than typical broadband which uses copper wires to send electrical signals.	Up to 1000Mbps
Wireless broadband	Mobile broadband	Mobile broadband is a wireless communication technology that uses mobile phone networks and can generate internet access to almost anywhere. This service is usually accessed through a mobile phone (smartphone).	Internet speeds vary. 4G speeds go up to 10Mbps for 4G 3rd generation. 4G speeds can go to 1000Mbps (1Gbps)
	Wireless hotspots	Wireless hotspots are places such as bars and cafes which offer you free access to their broadband connection. You may need to be a member to get the password for the wireless connection.	Depends on the internet service provider and how many people are logged on

### Research

Working in small groups or in pairs, research the differences between fibre to the home (FTTH) and fibre to the building (FTTB). How do these technologies work? What are the advantages and disadvantages of each?

- Cache memory Cache memory may be the memory that your computer has. The bigger the memory, the faster the computer will run. The cache memory is used to reduce the average time needed to access the memory. This means that the more memory you have, the quicker your computer is at dealing with the website you are accessing. The cache used by websites may be on the physical (eg hard drive in the form of temporary files) storage as well as within the computer's RAM.

- Browsers As discussed in the section on Browser compliance web browsers were not created equally. Some web browsers can affect the speed at which a web page can load.
- Interactivity When you incorporate interactive elements into a web page such as Flash images or games which are embedded, this can affect the speed at which the website can be loaded. The more interactivity a website has, the more time is needed for your computer system to download all the information. With new technologies such as 4G, 5G and fibre optics, this is less of a problem. Previously it took time for the information to download and consequently was used sparingly. Now interactivity is standard and users tend to expect it with websites.

**Assessment practice 6.1**

APT 6 AMI 6 AIN

You have applied for an apprenticeship with a website development company where you hope to prove to the recruitment manager that you are a competent website developer. Competition for the job is high so you have been set a preliminary report-writing task to gauge your understanding of website development principles. Applicants who perform well in this task will progress to the next stage of the recruitment process.

You are to identify two websites with a similar theme and compare the principles of website design that each website employs. It has been recommended that you take screenshots of any part of the website if you wish to back up your reasoning. You must conclude your report by analysing each website's suitability for their intended audience and purpose.

You should take this further and fully evaluate the way in which the principles of website design are used to produce creative, high performance websites which meet client requirements. You are free to choose which websites to use within your evaluation.

**Plan**

- What is the task? What am I being asked to do?
- How confident do I feel in my own abilities to complete this task? Are there any areas I think I may struggle with?

**Do**

- Have I spent some time planning my approach to the task at hand?
- Am I confident that I know what I am doing and that I know what it is I should be achieving?

**Review**

- I can explain what the task was and how I approached it.
- I can explain how I would approach the hard elements differently next time (i.e. what I would do differently).

## **B Design a website to meet client requirements**

Once you understand the principles behind good website design, you will need to put this knowledge into practice by designing a website.

### **Website design**

The website design process involves a number of steps which, if they were to be skipped, would cause major problems when the website goes live. There is a saying, 'If you fail to plan, you are planning to fail.' This saying very much applies to website development but also to any design and development project.

**Key term**

**Go live** - describes the first time a website has been uploaded to a web server and is made available to the public.

The more likely they will be to fulfil the requirements effectively. All the information about the requirements for the website will be collated within a problem definition statement.

**Intended audience**

Web designers must always have two sets of needs in mind: those of the client and those of the users. The client is the person who has commissioned the website and, usually, they are also the person who holds the purse strings. If the client is not happy with the website, you (the website developer) may not get paid for your work.

The users are the visitors to the website. They need to be attracted to the website initially and then encouraged to revisit to make more purchases, to look at new content or take part in discussions on forums. One aim of websites is to persuade their users to bookmark the website, which increases the probability of them returning on a regular basis.

**Full summary of the problem to be solved**

A website developer will need to understand the full problem to be solved. This will require communication between the developer and the client. There are a

### **Problem definition statement requirements**

Before a website can be built, a website developer must elicit as much information about the requirements of the website as they can from the client. The more information a website developer has about the client's requirements,

number of ways in which this can be done. A commonly used method of requirements gathering is called SQIRO. SQIRO stands for sampling, questionnaires, interviews, research and observations. A website developer will use these techniques with the client so as to gather as much information as possible to fully understand the problem that the creation of the website is intended to solve.

### Constraints

A client will need to understand the constraints of the website. The constraints are the limitations the website could have. Typical constraints of websites often include:

- ▶ money
- ▶ timescales
- ▶ staff training
- ▶ levels of security
- ▶ support and maintenance contracts.

### Tip

Within the IT industry, you are unlikely to ever be working alone. Most websites in the industry are built by teams, with different people working on different elements of the design and development. For instance, you may have a graphic designer working on images, a software tester, a website coder, a designer and so on. With so many people working on the same project, it is crucial that people learn to work as a team and support each other. If you do not work well together in a team and do not communicate well with each other, it is likely that the resulting website will not meet the client's requirements or will not be delivered on time.

### Benefits

The reason why a client will approach a website developer is for the potential benefits that a website will bring to their business. The benefits for a business of having a website include:

- ▶ advertising for your products/service and of the business worldwide
- ▶ less expensive than printed media, radio and television advertising
- ▶ more accessible (24/7, 365 days a year) (you do not need to turn away customers because it is closing time since a website is accessible to customers at all times)
- ▶ other websites may link to you, spreading the word about your business's products or services
- ▶ it gives you the opportunity to gain long term clients. (There is a difference between a client and customer. A customer is someone who walks in and buys something. A client is a regular customer who will often return to your website, which can help your business grow.)

### Nature of interactivity

Most modern websites involve interactivity; that is, they are **interactive websites**. You risk losing users if you have only a **static website**. It is important to decide how much interactivity will feature on a website. Too little interactivity and users may lose interest, too much interactivity and they may feel overwhelmed. It is important to get the balance right.

For e-commerce websites, the web designer also needs to decide how online transactions will be performed. There are two parts to this issue:

- 1 How will the user browse the catalogue? For example, how will the items be listed in the catalogue? Consider e-commerce websites such as Amazon™. Amazon™ has items which are catalogued in a hierarchical fashion, where you can filter your preferences, such as the relevancy, date added, price (in ascending or descending order) and customer reviews.
- 2 How will users make purchases? Before a user will purchase an item, the website will need to register their details and credit/debit card information. This information is encrypted using a method called **transport layer security (TLS)**. PayPal™ uses such a method because it stores all your financial information, such as credit card details, so you do not need to give these to the website you are purchasing from.

### Research

Research the terms server-side and client-side scripting. What is the difference between the two techniques? In pairs, see if you can draw a diagram that represents how these two techniques work. Look back at Factors affecting website performance to get you started.

### Key terms

**Interactive website** - involves some level of activity from a simple feedback form to a database that personalises the website for each individual visitor. Changes can be made to the website 'on-the-fly'.

**Static website** - one with no interactivity which is usually just a presentation of information. Changes to the website have to be hard-coded into the website.

**Transport layer security (TLS)** - is a protocol that makes certain that there is privacy between communicating applications and their users on the internet. TLS is the successor to the secure sockets layer (SSL) method.

## Purpose requirements

Once all the available information has been gathered the requirements are then generated. It is important that all the requirements that are gathered are SMART. When we refer to SMART requirements, we are saying that the requirements are as follows:

- ▶ Specific - Targets a specific area of improvement
- ▶ Measurable - It is possible to measure whether a requirement has been completed. That is, you can verify its completion. It is best to avoid any requirements that cannot be verified as complete.
- ▶ Achievable - The requirement must be achievable
- ▶ Realistic - The requirement can be realistically achieved with the available resources
- ▶ Time-constrained - The requirement can be achieved within the timeframe allocated

## Design ideas and prototyping

By this stage you should understand the client's requirements for the website and what it needs to do. Therefore you can use design tools to design a website which can be presented to the client for approval. Once the design has been approved, it can be used to create a website that goes live. It is important to consider the principles of good website design when you create a website and ensure that these are incorporated within it.

### Link

Look back at the Principles of website design to remind yourself of the fundamental principles which should be applied to any website design.

When developing any IT product, including websites, it is not uncommon for developers to build a prototype. This is usually done so that the user can have an idea of what the website will look like as well as what it will do. The idea for prototyping comes from engineering, where a prototype is often built before the construction on an assembly line to produce many copies.

Several tools can be used to ensure that all areas are considered when designing websites. By producing a thorough design, using the tools presented in this section, and using this design to communicate with your client, you can ensure that your client is happy with your plans before you build the website. This should reduce the problems that you would encounter if there was a mismatch between client expectations and the actual outcomes.

### Diagrammatic illustrations

To convey the concept of a website, you might use one or more of the following tools:



The aim of a mood board is to produce something with the same feel as the website (see Figure 6.3). It is a useful way of focusing the design and demonstrating initial ideas to the client. Think of a mood board as a sketchbook where you can collate images, different typographies, fonts, artwork, sample layouts and so on. The mood board can be presented to the client who can decide what they like and do not like on it. Their feedback and amendments to the mood board can then help to focus the website developer on what the website should look and feel like.



► Figure 6.3: Mood board picture example

## PAUSE POINT

Think of a website that you would like to develop. It could be for your favourite TV programme, your favourite computer game or an idea that you have for a business. For this website develop a list of:

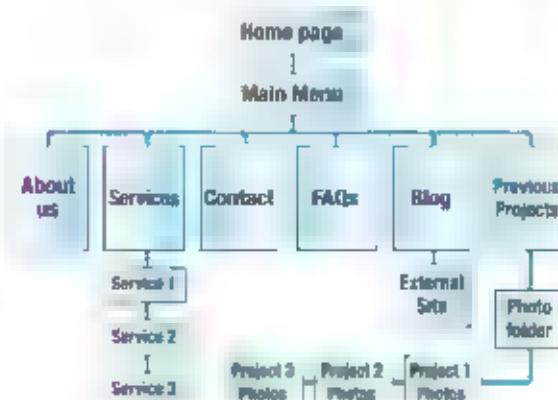
- 10 SMART requirements for the website
- 10 website requirements which are not SMART

Working with a peer compare your requirements and work together to see if they are correct or not.

What do you feel would be the implications for the design and development of a website if you did not have SMART requirements governing it?

## Storyboarding

Storyboarding is key to structuring a website clearly and is a way of expressing a navigational design (see Figure 6.4). Storyboarding is not just used in website design; it is often used in the design of moving images such as animations or films.



► Figure 6.4: Storyboard image artwork

## Realistic representation

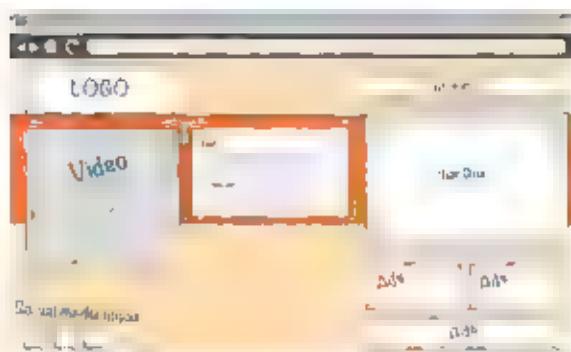
Your initial designs should give a realistic representation of what the website will look like. This is where it is important to be in communication with your client so that, upon seeing all your design documentation, the client can envisage what the website will actually look like.

### Wireframe

To visualise what the pages will look like before building them, designers create screen designs or wireframes (see Figure 6.5). Wireframes are mock-ups of the actual pages concentrating on layout rather than content. They also usually include some of basic **attributes** of the pages.

#### Key term

**Attributes** – additional information about your wireframe. For example, which font you will use, which font size you will use, where the sidebar will appear, alignment and so on.



► Figure 6.5: Wireframe artwork

## Site map

A site map is a list of pages of a website that is accessible to crawlers or users. It can be a document, in any form, which is also used as a planning tool for the website design, or a web page that lists the pages on a website. It also shows the relationship between the pages, representing how they are linked together.

## Search engine optimisation

When designing a website the developer will need to consider the best way to maximise the number of users who visit the website. Therefore, it is important that the design conveys an effective solution which users will want to keep returning to. Websites which receive more traffic are more likely to be ranked highly in search engine results pages, which will be beneficial to the business because users are likely to click on the first relevant link they see. A good design is not in itself enough to get more users visiting a website, although it might mean that those who find the website will return. To get more users visiting your website in the first place, you need to employ SEO techniques to ensure that your website appears at the top of search engine results pages.

### Link

For more on SEO see Search engine optimisation

## PAUSE POINT

Think of a scene from your favorite film or cartoon. Create a storyboard to show what happens. Use a minimum of 10 boxes and a maximum of 20. Add any notes underneath each box to explain what is happening.

Most storyboards need to be sketched out on paper. You can use Microsoft® Office® packages such as Word® and PowerPoint® to develop storyboards using the insert feature ribbon.

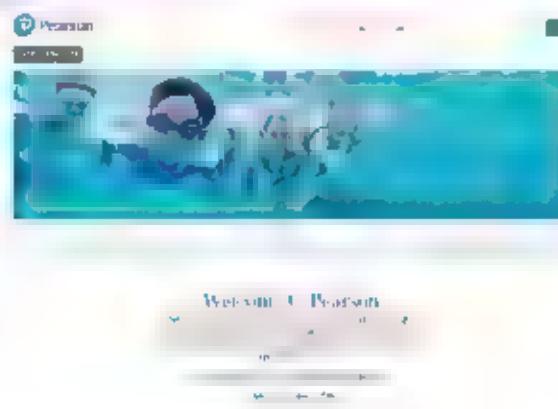
Add colour to your storyboard to show contrast and to give your storyboard a more realistic representation.

## Alternative design ideas

Alternative design ideas should be considered and thought through in case problems are identified with your preferred design and also to give clients more choice in terms of the design they decide to go with. Alternative design ideas can be presented within your mood board and in storyboards. Once the client is happy with a particular design you can focus on this design in a wireframe. Consideration must be given to design compatibility with mobile devices, this is something that will need to be discussed in the requirements stage. It is common these days for businesses to develop mobile-friendly versions of their websites. However for smaller businesses, it might not be possible to develop a separate mobile website so the one website needs to be suitable for viewing on desktop computers and on mobile devices. With HTML5 it is now more common to develop a responsive website that dynamically adjusts elements to work in any size browser/screen without having multiple versions to maintain.

### Discussion

Using your PC go to uk.pearson.com to be consistent with screenshots and notice the design (see Figure 6.6). Now using your smartphone or tablet device go to uk.pearson.com (see Figure 6.7). Can you see the difference? Notice how the two websites look different despite being the same website. This is done for user convenience and compatibility. Discuss, in your class, how you think a website developer would go about making this possible?



► Figure 6.6: uk.pearson.com (desktop view)

## Client-side scripting design

Client-side scripting refers to websites where the script is executed client side (by the user's web browser) instead of server side (on the web server). JavaScript is a programming language that enables client-side scripting and can be used to create interactivity within web pages.

Prior to coding or scripting, appropriate designing must take place. This must be done to inform a website developer of the function that the website must perform. When they have all available design documentation, the website developer can then create the website.

### Flowcharts

Flowcharts are diagrams that are used by software developers to represent a solution to a given problem. Flowcharts involve boxes of different kinds, used to represent different things, and arrows that show how the boxes relate to one another (see Table 6.3 and Figure 6.8).

► Table 6.3: British Computer Society (BCS) flowchart symbols with descriptions

Flowchart symbol	Description
An oval shape represents a start or end point.	An oval shape represents a start or end point.
An arrow is a connector that shows the relationship between representative shapes.	An arrow is a connector that shows the relationship between representative shapes.
A rectangle shape represents a process.	A rectangle shape represents a process.
A parallelogram represents where an input or output will take place.	A parallelogram represents where an input or output will take place.
A diamond shape represents where a decision will be made.	A diamond shape represents where a decision will be made.

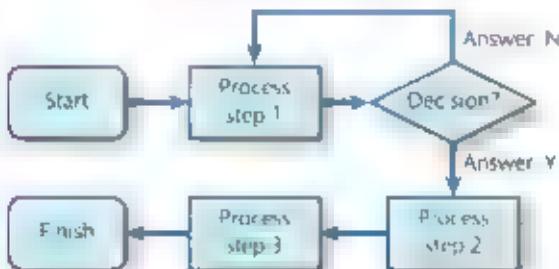


Welcome to Pearson

► Figure 6.7: uk.pearson.com (mobile view)

### Tip

Decisions are essentially IF statements. Therefore there will always be a minimum of two arrows coming from a decision (diamond), each one representing a decision eg Yes or No.



► Figure 6.8: A flowchart example

### Pseudocode

Pseudocode helps programmers develop **algorithms** by forming an intermediary step between an explanation in English (or another natural language) and the coding language. By using pseudocode, a designer can plan what the code will do without having to worry about ensuring that the correct words and syntax are used.

### Link

Refer to Unit 4, Software Design and Development Project for a full itinerary on pseudocode and its conventions

### Key term

**Algorithm** is a procedure or formula for solving a problem

### Ready-made and/or original assets

Assets include animations, graphics, audio and videos. All of these assets can be embedded within a web page to provide additional interactivity, information or context.

► Table 6.6: Pseudocode example and JavaScript equivalent

#### Pseudocode

```
Age = input from user  
If age >= 18 then  
    Print onscreen "Hello World"  
    Else  
        Print onscreen "I am x years old"
```

#### JavaScript

```
Age=prompt("Enter age", "")  
if (age>=18){  
}  
else {  
}  
document.write("I am "+age+" years old")
```

### Ready-made assets

It is important, if you are using pre-existing, ready-made assets, that you seek the owner's permission to use their assets on your website, as there could be copyright issues. If you do not seek the owner's permission to use an asset, you will be in breach of the UK's Copyright, Designs and Patents Act 1988. The maximum penalty for breaking this law is a possible prison sentence and/or a large fine. Therefore it is essential that you get permission from the owner of any asset that is not copyright free before using it in your website. Getting permission will sometimes, but not always, involve paying a fee.

### Original assets

It is simpler to use original assets, that is, ones that you have created yourself from scratch. Any animations, graphics, audio or video that you create yourself can be embedded within your website without any possibility of infringement of copyright, as long as they are not based in any way on someone else's work. (You are the copyright owner of these assets.) You do, however need to be careful of certain issues when creating your own original assets, for example photographs. If you take photographs of people, you need them to sign a model release form that gives you permission to use the photograph that they appear in as you wish.

### Obtaining and using feedback from others

When you have completed your website designs it is important to gather feedback from others (including the client and potential users) to see if the designs meet the requirements and could be refined in any way to make them better. This is a crucial part of the design and development process because if issues were found with the design after the developer starts building the website this is likely to lead to delays. Also the website may not be as good as it might have been, because time and cost constraints might mean that compromises have to be made. Therefore, it is important to obtain feedback on designs before they are implemented, to determine if any refinements need to be made.

The feedback stage is also an opportunity to identify any technical and design constraints. By identifying them at this stage, you will be able to come up with alternative

design solutions to overcome any constraints, before it is too late to do anything about them. In addition, the website development process is recursive, meaning that you can go back and adapt the designs to factor in the feedback of others before going ahead with development, not just once but repeatedly until the design is right (keeping in mind time and cost constraints, of course).

One method of obtaining feedback is to use a questionnaire. Questionnaires can be used to gather feedback and determine areas of strength and areas in need of improvement. Questionnaires use two main types of questioning: **quantitative** and **qualitative**.

#### Examples of quantitative questioning

- ▶ On a scale of 1-10 how would you rate the overall aesthetics of the website?
- ▶ Could you navigate through the website effectively? With answer options such as 'Yes, easily' 'Yes' 'Yes with difficulty' 'No' 'No, it was very difficult'
- ▶ Did you find the pop up boxes a distraction or were they beneficial? With answers options such as 'Distraction' or 'Beneficial'

#### Examples of qualitative questioning

- ▶ What did you enjoy most about the website?
- ▶ How could we improve your website experience?
- ▶ Do you have any feedback about the website you think we should be aware of?

#### Key terms

**Quantitative questioning** questions have a definitive answer either a numerical value or specific answers in ranges. It focuses on statistical analysis.

**Qualitative questioning** questions do not have definitive answers. It provides answers as to how or why and is used to gauge opinions and get more detailed feedback.

#### Link

For more on quantitative and qualitative questioning see Test users and user feedback in Unit 7: Mobile Apps Development.

#### Using the test information

It is recommended that you get several people to test your website. This is because someone may identify an issue not noticed by yourself or your other testers. However, you cannot test forever as you will be bound by time and budget constraints. Therefore, once you have the information, you must use it to refine the website, where necessary. Any errors that are spotted must be changed. For example, if a link within the website does not work as expected, this must be resolved. It is also an opportunity for the website to be tested on different web browsers.

## ① PAUSE POINT

### Part 1:

Create a wireframe for a website based on a theme of your choosing. This wireframe will be for the homepage. Be sure to include all necessary tributes in your design and to apply the principles of website design.

### Part 2:

Develop a questionnaire for potential users about your homepage which poses five quantitative questions and five qualitative questions.

### Part 3:

Ask a peer in your group to complete your questionnaire about your homepage. They should answer your quantitative and qualitative questions and critique your wireframe design, citing any areas in need of improvement. If you are able, ask more than one person to complete your questionnaire; this could include family and friends.

### Part 4:

Based on the questionnaire feedback, make any necessary or beneficial refinements to your wireframe design for the homepage.

#### TOP TIP

If you are developing your wireframe using a package such as Microsoft® Word® or Excel®, remember to change the page orientation to landscape to give you more room. Also, annotate your designs effectively using the Comments feature within the Review section of the ribbon.

#### TOP TIP

Explain how your website fulfils the fundamental principles of website design. Annotate your wireframe design indicating where you have adopted these principles.

and on different mobile devices. Different web browsers render code in different ways, which is why some websites look different depending on which web browser you are using.

This test data is invaluable, as you can then refine the website and streamline it to make sure that it is fit for purpose and meets the needs of the client.

#### Discussion

In small groups or in pairs, discuss why it is important to get other people to test your website. What do you feel are the implications of not doing so? Furthermore what are the potential problems of testing a website yourself only?

### Testing plan

A testing plan is used to test functionality. In other words, a testing plan is used to check that all parts of the website work as they should. Sometimes, this is referred to as 'black box' testing as it focuses on functionality as opposed to the internal mechanics or workings of a program. This is where, prior to the website being built, a series of tests or test data is developed so that, when the website is built, the test data can be used to see if all parts of the website work as they should.

#### Research

Compare black box testing to white box testing. What are the differences between the two?

#### Link

For more on black box testing see Testing a mobile app in Unit 7: Mobile Apps Developments.

The elements that occur within a test plan are:

- ▶ test number
- ▶ purpose of test
- ▶ additional data on test eg which web page
- ▶ test data
- ▶ expected results

#### PAUSE POINT

Develop a series of 10 tests which could be used to test the functionality of a website of your own choosing.

If you are not comfortable using tables in Word – to do this consider using Excel which is just as effective.

Work with a peer within your group to see what additional tests they have thought of and apply these to your test plan. This will help both of you to have a wider range of tests in your test plans.

#### Link

For explanations of these elements of a test plan see Test plans in Unit 5: Data modelling.

#### Tip

When developing your test plan, change your page orientation to landscape. This will give you more space and enable you to type more.

### Example testing plan

Remember to test all parts of the website and not just those elements that appear on the home page. It is important to test a range of features and attributes of the web pages, not just the links. For example you should test whether images appear but also test for browser compliance that is, ensure that it looks correct in different browsers. See Table 6.5 for part of an example test plan.

► Table 6.5 Example test plan

Test number	Purpose of test	On page	Test data	Expected result
1	Test the home button	about.html	Left click	Load home.html
2	Logo.gif	home.html	Load page	Appears in the centre of the page
3	Test the alt/title tag of logo.gif	home.html	Hover over Logo	Tool tip appears

#### Link

Refer to Unit 4: Software Design and Development Project for more details on testing.

### Technical and design constraints

Constraints are limitations or restrictions that may make it more difficult to design and develop a website. They may limit the scope or complexity of the website you design. Constraints tend to fit into two categories: technical and design constraints. Some of the possible constraints are outlined here.



## Technical constraints

- ▶ **IT staff** – The skills needed for the creation of the website might not be available, meaning that staff would need to be trained or recruited to complete the required design and development work
- ▶ **IT equipment** – The website might require specialised hardware or software that may need to be bought in or installed before the website design and development can proceed.

## Design constraints

- ▶ **Financial** – The client's requirements for their website might not be feasible within their budget. A budget will have been agreed with the client and you have to work within that budget. However if the client wants features that would cost more than the budget, you can present this information to the client. They may choose to increase the budget so that they can have the additional features or they may compromise on the features to keep the budget the same.

### Theory into practice

When undertaking a project which requires you to be time constrained (it needs to be built by a specified date), it is important that timescales are built in to ensure that the final website is completed on time.

When working in the IT industry, it is extremely likely that you will be given tasks that need to be completed within a specified time frame. Therefore, you have to set relevant targets with deadlines for when each target needs to be achieved. This must include contingency planning, such as taking into consideration the feedback from others (and so having to make improvements) as well as the possibility that you might be ill for a few days.

- 1 Write a list of sensible targets which could be given specified deadlines for the process of designing and developing a website; that is, milestones within the design and development.
- 2 Once you have this list of milestones, allocate amounts of time for the completion of each of these stages.
- 3 Put each stage into a schedule, using the amount of time allocated for each stage, to determine the dates by which they would need to be completed (using an end date of your choice).
- 4 Write a list of factors that might affect your ability to complete your milestones on time, such as being ill.

- ▶ **Flexibility** – You need to design a website to work on different platforms (both on desktop computers and mobile devices), then you will need to consider this constraint when designing the website.

## Legal and ethical considerations

We need to consider the legal and ethical considerations involved when designing and developing websites. For example, there are laws that protect an individual's intellectual property and those that ensure that an individual's personal data is not released.

### Copyright, Designs and Patents Act 1988

The Copyright, Designs and Patents Act 1988 protects all original works such as music, art, writing and programming code once it is tangible which means once it is in a fixed form (for example a music album is released or a book is published). These original works are the intellectual property of the individuals who created them. As the internet has become such an important part of everyday life, the question of whether websites are subject to protection under copyright laws has often been discussed. It is now accepted that a website becomes tangible once it is coded and saved onto storage media, so websites are now protected by copyright.

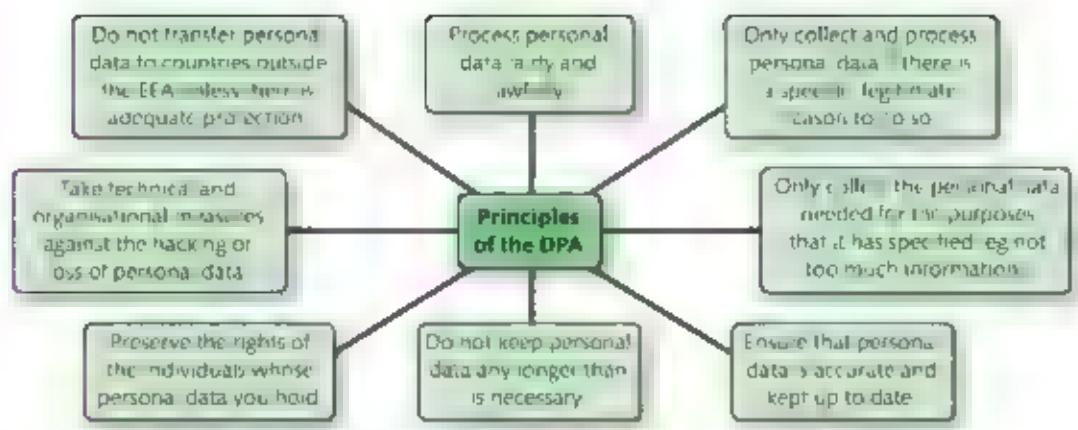
### Data Protection Act 1998

The Data Protection Act 1998 was designed to protect sensitive data held in databases. It was originally passed in 1984, with an update in 1998, which was brought into effect in 2000. It is upheld by the Information Commissioner's Office. Every business that stores data (that is, information about customers), must register and state the data they plan to hold.

There are eight principles of the Data Protection Act 1998 (see Figure 6.9). The data subject is the person to whom the data refers. Under the act, the data subject has several specific rights, including:

- ▶ the right to compensation for unauthorised disclosure of data
- ▶ the right to get inaccurate data corrected or removed
- ▶ the right to access data and apply for verification or erasure where it is inaccurate

Prior to development, a website designer must consider how the Data Protection Act could affect their website. For example, a website that collects users' data, such as an enquiry form asking for personal information (eg your surname, forename and phone number) should include a Privacy Policy that informs website visitors how you retain, process, disclose and purge their data in line with the act.



► Figure 6.9: The eight principles of the Data Protection Act 1998

## 11 PAUSE POINT

Think about a website with which you are familiar such as your school or college website.

How do the laws listed affect the content and running of the website?



Consider working with a peer in your group to exchange and collaborate on ideas.



Consider what would happen if your school or college website did not abide by these laws. What would be the consequences?

## Common tools and techniques used to produce websites

It is important that, once appropriate designs have been approved and completed, different tools and techniques for development are explored in order to meet the client requirements.

### HTML

HTML (hypertext markup language) is the most commonly used markup language, so much so that all others are just about extinct. It forms the basis of all worldwide web pages, even if other languages are used for parts of them.

HTML uses a system of tags (indicated by angle brackets < and >) which contain the instructions. Almost all instructions come in a pair of open and closed tags enclosing the content to be affected. For example <font color="red">Some text</font> would produce 'Some text'. Note that American spelling is used in HTML. HTML pages should start with <html> and end with </html> tags to declare the language being used.

### HTML5

HTML5 is the current hypertext markup language standard used for structuring and presenting content on the

worldwide web. Website developers should always work to the current standard so, when developing your web pages, you should code using this standard. Tags for changing the font are no longer required in HTML5. Instead, cascading style sheets (CSS) should be used. It is likely that there will be subsequent updates, leading to HTML6, which will then become the new standard that website developers should use.

HTML5 was finalised by the **World Wide Web Consortium (W3C)**. HTML5 has a larger set of technologies that allows for more diverse interactivity and more powerful websites and applications.

#### Link

For an introduction to HTML5 elements and tags see HTML5 Introduction at [www.w3schools.com](http://www.w3schools.com)

#### Key term

**World Wide Web Consortium (W3C)** an international community that develops open standards for the use of HTML5 to ensure the long term growth of the worldwide web

## Tables

Tables used in HTML began with the `<table>` tag. Tables should not be used to structure websites (which has been done in the past, because it causes accessibility and browser rendering issues). Instead the `<table>` tag should be used only to present a table on a web page for example - you are presenting the opening times of a shop.

## Forms

Forms are used in website development to collect user input. There are different ways of collecting user input using forms.

- ▶ Text field - This defines a one-line input field for text input.

```
<form>
    Please enter your first name <br>
    <input type="text" name="firstname">
    <br>
    Please enter your age <br>
    <input type="text" name="age">
</form>
```

- ▶ Text area - Allows you to have more user input

```
<form>
    <textarea name="textarea"> Please enter your text here </textarea>
</form>
```

- ▶ Submit button - Defines a button for submitting a form to a form handler

```
<form action="test_page.php">
    Where were you born? <br>
    <input type="text" name="birthplace">
    <br>
    Where do you currently live? <br>
    <input type="text" name="livingplace">
    <input type="submit" value="submit">
</form>
```

- ▶ Radio buttons - Radio buttons let a user select one of a limited number of choices

```
<form>
    Are you sure?
    <input type="radio" name="validation" value="yes" checked>YES
    <br>
    <input type="radio" name="validation" value="no">NO
</form>
```

- ▶ Check boxes - As opposed to radio buttons which only let you select one of a limited number of choices, check boxes allow you to select more than one choice

```
<form>
    I own the following: <br>
    <input type="checkbox" name="games">Playstation<br>
    <input type="checkbox" name="games">XBox<br>
</form>
```

## Navigation

Navigation is a way of moving around a web page to find what you need. At first the worldwide web was restricted to simply using hyperlinks. However as time has progressed and technology has advanced, new ways of navigating a website have been developed.

- ▶ Menus - Menus can appear anywhere within a web page but most website developers tend to place them towards the top of a web page. Instead of traditional hyperlinks, these menus are more attractive and aesthetically pleasing. Visitors to a website can click on a menu and it will redirect them to the page they are looking for. Alternatively, sometimes when you hover over a menu a sub-menu will appear (see Figure 6.10)



▶ Figure 6.10: Menu and sub-menu

- ▶ Hyperlinks - Hyperlinks are links that, when clicked on, take you to a particular part of the website (an internal link) or they will take you to another website (an external link). Hyperlinks can be text, images or buttons
- ▶ Anchors - Anchors are used to redirect a visitor to a certain part of a web page. For example, if you are reading a long document online, at the beginning of the web page there will be links to the beginning of each section within the document. By clicking on one of these section links you will be redirected to the precise point in the web page that you require

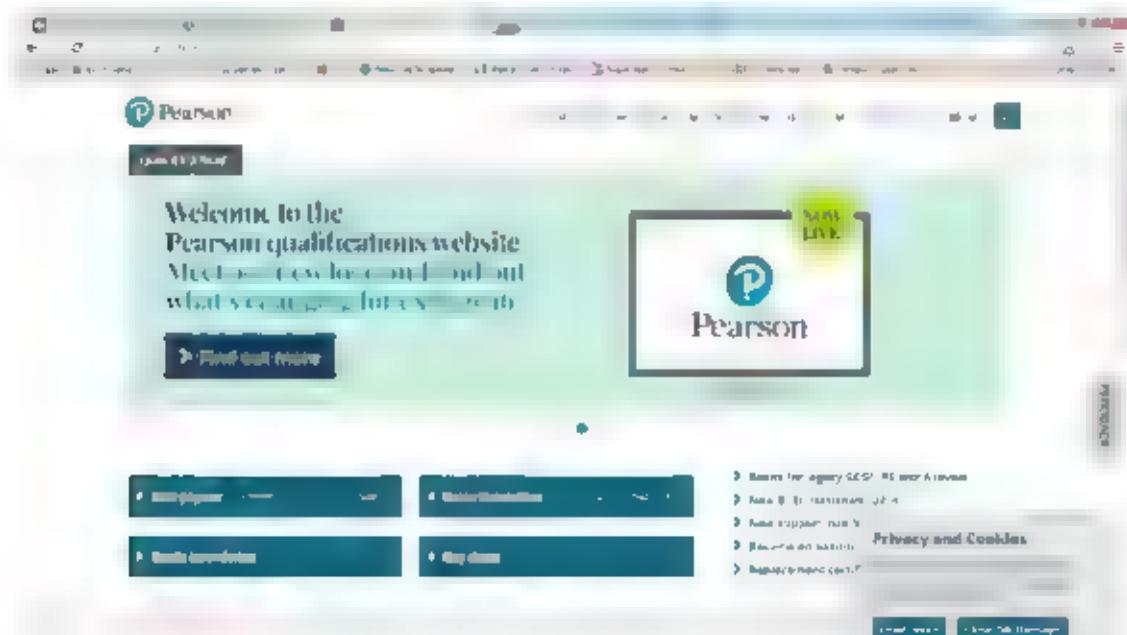
## Interactive components

Interactive components are used as a means of enhancing the look and feel of a website. However, a web page should not be cluttered with too many interactive components because they increase the download time and can make a website look amateurish. Interactivity involves two-way communication between the user and the computer. In other words, it requires input from the user which provokes a response from the computer. This could include giving feedback, searching a catalogue of products or purchasing a product from a website. To have a full catalogue of products would require a database and server-side scripting.

### Research

What are the components involved in server-side scripting? Research, compare and contrast PHP with ASP. Which do you believe is best suited for server-side processing?

- ▶ Hot spots - A hot spot is an area of an image that acts as a hyperlink. When a person clicks on a hot spot a hyperlink takes the user to another web page
- ▶ Pop-ups - These are small internet windows that pop up on your screen to get a user's attention (see Figure 6.11). Sometimes they can be considered annoying or dangerous. They are often used by advertisers. The first



▶ Figure 6.11: Cookie pop-up on Pearson Qualifications website

time you visit a website, a pop-up will appear to tell you that cookies for that website will be downloaded to your PC (this is now a legal requirement) and you have to accept them to continue using the website. The cookie that is downloaded remembers that you have visited the website, so the next time you visit it the pop up will not appear. However, the cookie might have tailored the website based on any customisable choices you made last time you visited.

- ▶ **Buttons** - These look like command buttons in that when you press them they will depress like a conventional button. Buttons have different purposes one of which can be to take you to another web page.
- ▶ **Rollover images** - A rollover image is a secondary image loaded into your web page to display when a user on your website rolls their mouse over (rolls over) a certain image within your website. It is used to make your website more interactive. For example, some clothing websites display one image of a piece of clothing but when you roll over the image another view of the piece of clothing is shown.

### Colour schemes, styles and templates

- ▶ Modern web design, within HTML5, uses templates with built-in colour schemes and styles. There are templates which are free to download and some that you have to pay for. These templates are built using a technique called cascading style sheets (CSS), which is discussed further in the next section.
- ▶ What makes an appropriate or pleasing template is subjective; that is, a matter of opinion. Quite often the colour scheme and styles used by your website will determine its theme. Therefore for you must choose appropriate colours and styles for the type and content of your website. For example, if you are producing a website for a nursery, it would make sense to use a playful font and a variety of bright colours, whereas, if you are producing a professional corporate website, then a more minimalistic look using a small colour palette and contrasting backgrounds is considered best.

#### Discussion

Investigate different colour combinations that you could use for a website which is education based. Think about accessibility issues such as colour blindness. Discuss, in a small groups, which colour combinations would be best suited and explain your reasoning. Use the BBC website for more information.

### Cascading style sheets

It is good practice to use the same layout and styling throughout a website. Cascading style sheets (CSS) are used to ensure standardised formatting across a website. CSS allows you to create a standard layout and style which can easily be applied across all the web pages within a website. They are cascading in that when you make a change in one place within a website this change will be cascaded to all the web pages within the website that use that style. This makes altering and maintaining the design of the website much easier. For example, in HTML to change the font colour of all the titles in a website to red would have involved changing each one individually. But now, using HTML5 and CSS, only one value would need to be changed, and the change would be immediately applied throughout the website for every title.

#### Link

For more on how to apply CSS to web pages see Using cascading style sheets

### The World Wide Web Consortium

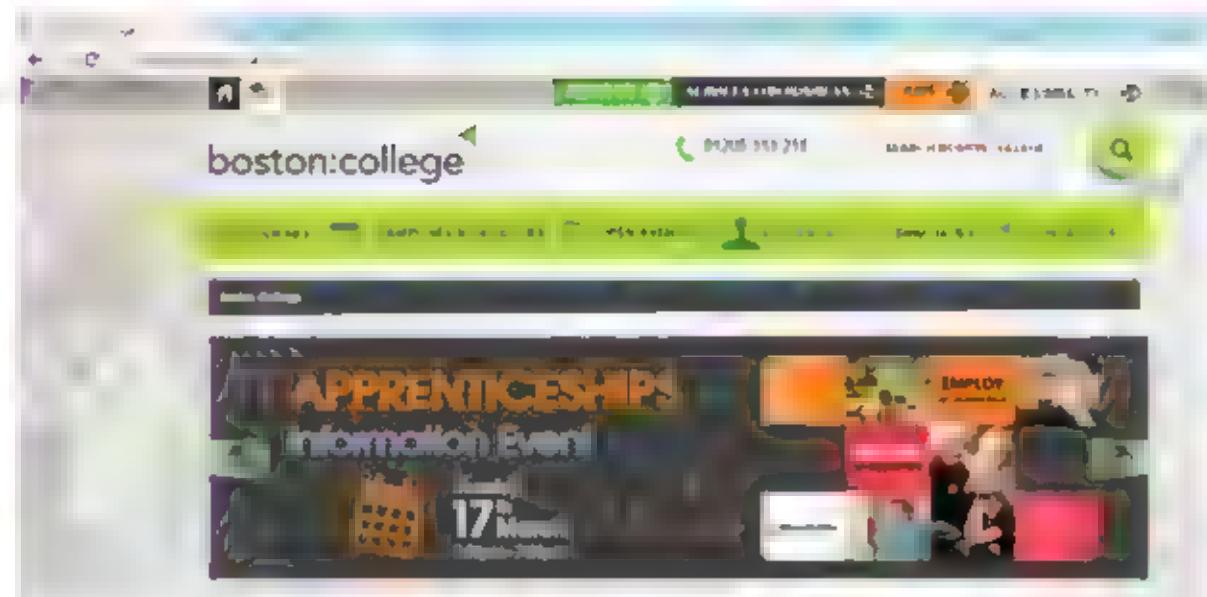
The World Wide Web Consortium (W3C) is a body which promotes the standardisation of web design, especially of HTML. It aims to ensure universal accessibility of the web. For example, they promote the need for all websites to be displayed on a variety of browsers and resolutions so that they are usable by people with special needs. The W3C produces guidelines and tools for standardising websites which contribute towards increased accessibility. HTML compliance plays an important factor in this because if we use outdated HTML coding techniques or conventions this prevents a website from becoming fully accessible.

#### Link

For more on the W3C and their Web Accessibility Initiative visit their website: <http://www.w3.org/WAI/>

### Accessibility features

- ▶ **Alternative tags (alt tag)** - An alt tag is a text alternative for an image or object on your web page (see Figure 6.12). If the image cannot be displayed the alt tag will be read in its place. The alt tag will be read by screen readers and other website readers as an alternative to the image itself. This is a necessity for blind users who use the internet, as the screen reader will tell the blind user what the image is, by reading the alt tag aloud. Therefore alt tags need to be meaningful; that is, say what is shown in the image in the context of the text on the page.



► **Figure 6.12:** As you can see by hovering over the magnifying glass, the title tap is clearly stated as 'Search'. This means that a screen reader will be able to read this and a blind person will know where the icon is.

- ▶ **Zoom features** - Web browsers have a feature which allows the user to zoom in or out making the content on the screen larger or smaller depending on their preference. This is particularly useful for users who have poor vision.
- ▶ **Text-to-speech** - For visually impaired users, text-to-speech (TTS) is very useful. It is a type of speech synthesis application that is used to create a spoken sound version of the text in a web page.

### Platform compatibility

When developing websites, it is important that they are tested across a range of different platforms, particularly if it is part of the client's brief that the website should be usable on these platforms. These platforms can be broken into three categories:

- ▶ web browsers
- ▶ operating systems
- ▶ mobile devices.

When testing a website, you must ensure that it has a consistent appearance across these different platforms. The consequence of not doing this is that your website may display incorrectly on one or more web browsers using a particular operating system or on certain mobile devices. Consider that every user visiting your website may use a different combination of browser and operating system or be using a mobile device. Therefore you must

cater for all platforms and test your website to ensure that it appears the same across them all.

Obviously developing a website to be compatible across multiple platforms is expensive so this is an important constraint and consideration for clients and website developers. It might be that, initially, a client decides to focus on ensuring compatibility with only the most popular web browsers and the most popular mobile device operating systems with the intention of ensuring compatibility with the others once the website has been established successfully on the most popular ones.

### Embedding and compression of assets into suitable file types

Compression is a way of making a file smaller so that it uses less disk space. By using smaller file types that use compression methods, the website will have a faster download time making it more user-friendly. When deciding on which file types to use, a website developer must make a judgement in order to balance quality and file size because the higher the quality the larger the file size. Once you have put your assets into the appropriate file types, they can be embedded within your web page. However, consideration also needs to be given as to what type of asset you are going to select.

#### Image files

There are two image file types available: bitmap and vector

Bitmap file types include .gif and .jpeg. A .gif file has a maximum palette of 256 colours, and should, therefore, be used when the quality of the colour images is not that high and for images that do not contain many shades of colour. A .jpeg has a larger colour palette and is, therefore, better for high-quality colour images that include a lot of shading.

For a comparison of bitmap and vector images, see Table 6.6.

### Digital sound files

Sound travels in waves. Natural sound waves are continuous and analogue. Digital sound waves are sampled at regular intervals with gaps, which are so small that the human ear cannot detect them. Once these signals are combined, the whole piece is a series of waves that denote the characteristics of the sound. As a computer can only understand 0s and 1s, the value of each part of the wave is converted into a binary value. For example 0000 0001 0010, 0011. These values are then translated by the computer into sound output.

There are several types of sound file type available, each with its own method of sampling and compression. A .wav file has a high sample rate, which means that the sound quality is closest to that produced by actual instruments, but it has a relatively large file size. A .mp3 file tends to have a lower sample rate and therefore produces a smaller file size. (This is how MP3 players manage to store such a high volume of music.) However, there is a loss of quality with .mp3 files compared with .wav files, depending on the compression rate chosen. The higher the compression rate, the smaller the file size, but this is at the cost of some fidelity. Consideration must also be given to the types of music plug-ins that a user is likely to have, as this may restrict the choice of compression rate available.

► Table 6.6: Comparison of bitmap and vector images

Feature	Bitmap	Vector
Nature of file type	Each pixel is saved individually with its location, colours and other details.	Coordinates of points and curves are saved as a mathematical equation.
File size	Generally has a large file size.	Generally has a small file size.
Resizing	The image will become pixelated.	The image will retain clarity.
File formats	.bmp, .gif, .jpg, .png	.pdf and .eps
Created by	Programs such as Microsoft® Paint and Adobe® Photoshop®	Programs such as Adobe® Illustrator® and CorelDRAW®
Used for	Usually used in web pages as they are rendered by all graphical browsers.	Often used for graphics such as logos which need to be resized.
Shapes	N/A	Drawn in Adobe® Flash®

### Key term

**Plug-in** Software that will play specific types of files. For example, modern versions of web browsers like Internet® Explorer® come with Flash® Player which is a plug-in to allow the user to play Flash® animations.

### Digital video and animation files

Videos and animations can seriously affect the speed at which a website is able to load and, in general, should be used sparingly. Both video and animation file types can produce very large file sizes.

Traditionally for users to be able to view videos or animations embedded within a web page, they used to have to click on them and download them. Due to the size of the files, this would often take a relatively long time and control a large proportion of bandwidth during the download, even with a high-quality internet connection. Files like this also take up a large proportion of web server space. However, with the advent of HTML5, more videos are being embedded into web pages which can now show animations and video without the need of a plug-in. Therefore, there is no longer the requirement for constant plug-in updates and this means that videos and animations will run much more quickly and seamlessly.

### Exporting digital assets

Once your digital assets have been created and developed using an appropriate file type, these files can then be exported for website use. When exporting your files, you should develop a folder directory which will store all your assets including images, sounds, videos and animations, as well as CSS files. This will mean that all your files will be stored appropriately and you will be able to refer to them when you code your website solution.

# C

## Develop a website to meet client requirements

Once your website design is complete when it has been tested, when all the assets have been prepared and when the client has approved it, the website can be built.

### Website development

The first element that needs to be created to build an interactive website is the structure. This will provide a solid basis for the content which can then be easily inserted. Extra features, such as interactive and audio-visual elements can then be added. Once the website has been built, all elements must then be tested to ensure that they are functioning correctly. Once the website developer is happy that there are no bugs in the website, it can be uploaded to a web server and go live on the internet. This section will cover the creation of interactive websites.

### Using cascading style sheets and accessing CSS from HTML

Cascading style sheets (CSS) allow you to create a standard layout and style which can be easily used on each web page in the site. Due to this standardisation, it is also easier to alter and maintain the site. For example, in HTML to change the font colour of all the titles to green would involve changing each one individually. When using CSS, only one value would need to be changed and the change would immediately be applied (cascaded) throughout the whole site for every title.

CSS can be written into the HTML in three different ways: inline, header and external.

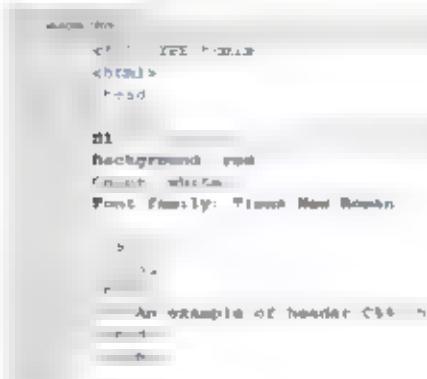
#### Inline

The CSS is defined in the same area of the code as the tag to which it is to be applied.



#### Header

The CSS is defined in the head section of each web page and applied throughout the website.



**External**

The CSS is defined in a separate file which all web pages can reference. This is a .css file rather than a .html file. The one which can be put in the head of the HTML to link to the external CSS pages, is shown in Figure 6.13.

The screenshot shows a browser window with two tabs. The top tab is titled 'index.html' and contains the following HTML code:

```
<!DOCTYPE html>
<html>
  <head>
    <link href="styles.css" rel="stylesheet"/>
  </head>
  <body>
    <h1>This is demonstrating what happens to the header tag</h1>
    <p>This is demonstrating what happens to the paragraph tag</p>
  </body>
</html>
```

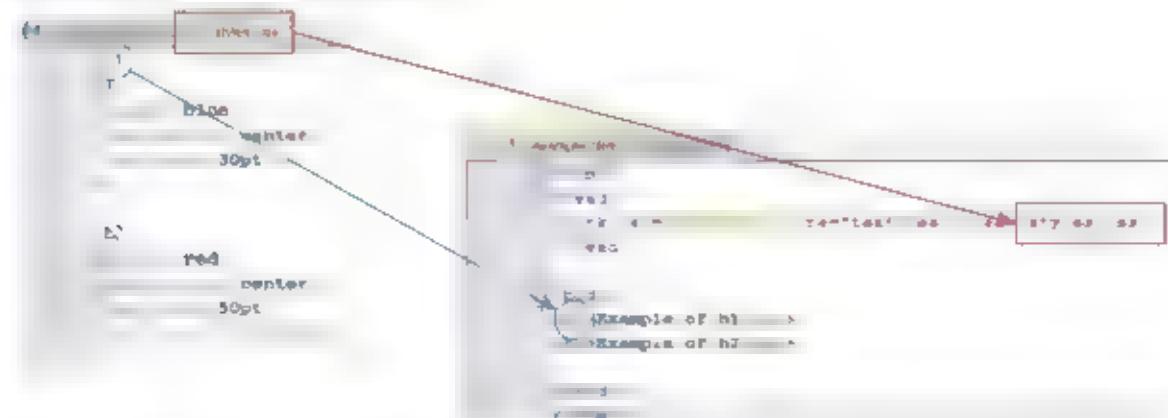
The bottom tab is titled 'styles.css' and contains the following CSS code:

```
h1 {
  color: green;
  font-size: 25pt;
  text-align: center;
  font-weight: bold;
  margin: 0 auto;
  width: 200px;
}

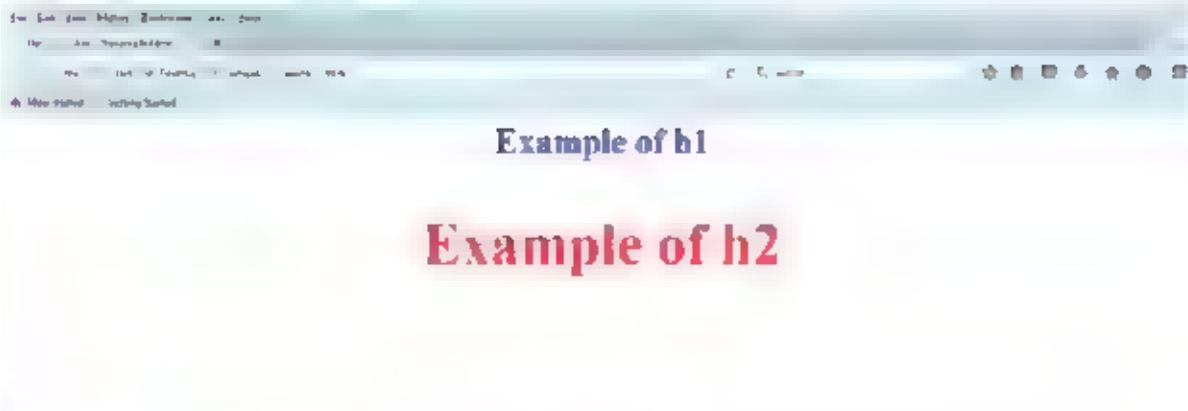
p {
  color: white;
}
```

The browser displays the rendered HTML where the **h1** tag has a green font, a size of 25pt, and is centered with a width of 200px. The **p** tag has a white color.

See the examples in Figure 6.13 and Figure 6.14



► Figure 6.13: Example 1 of external CSS being applied



► Figure 6.14: Example 2 of external CSS being applied

### Other features of CSS

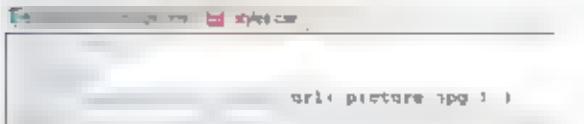
CSS can be used to alter the layout and formatting of any web page. Here are some examples of the hundreds of properties that can be changed.

These properties use the external method of applying CSS

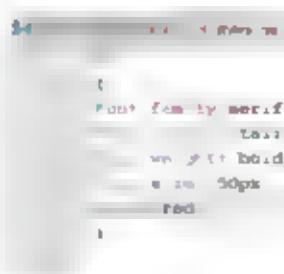
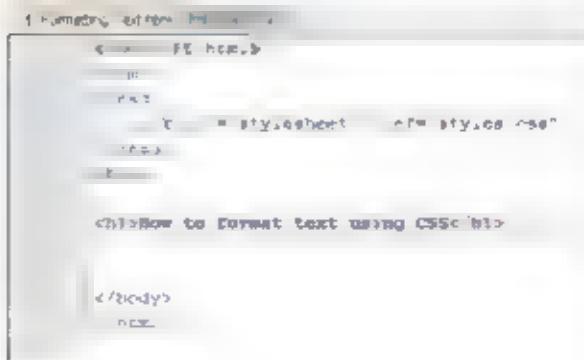
#### ► Changing the background colour



#### ► Changing the background image

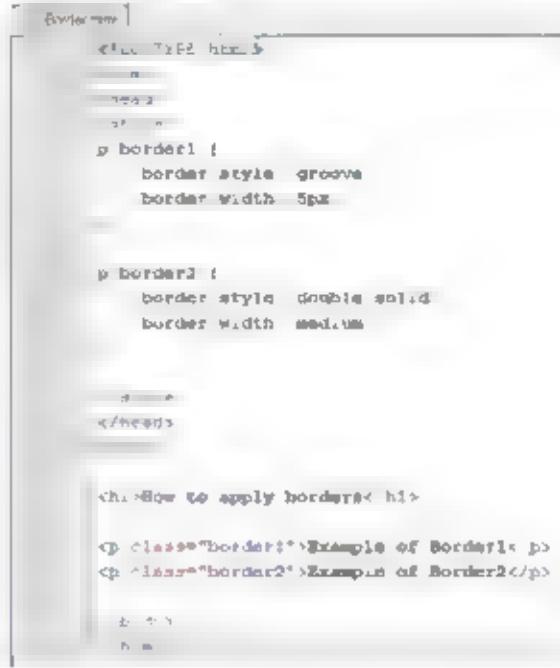


#### ► Formatting text



These properties use the header method of applying CSS

#### ► Applying borders



## ▶ Applying padding

The screenshot shows a table with the following structure and data:

```

<table border="1">
    <tr>
        <td>padding: 15px;</td>
    </tr>
    <tr>
        <td>
            <table border="1">
                <tr>
                    <td>First name:</td>
                    <td>Last name:</td>
                    <td>Sex:</td>
                </tr>
                <tr>
                    <td>Michael</td>
                    <td>Roxanne</td>
                    <td>Female</td>
                </tr>
                <tr>
                    <td>Michael</td>
                    <td>Patty</td>
                    <td>Male</td>
                </tr>
                <tr>
                    <td>Kevin</td>
                    <td>Andrew</td>
                    <td>Male</td>
                </tr>
            </table>
        </td>
    </tr>
    <tr>
        <td>More...</td>
    </tr>

```

## Step by step: Creating a simple CSS Page

4 Steps

**1** Open Notepad++ or similar text editor. Save the file as myCSSwebpage.html.

**2** Enter this code and then save the file.

The code entered in Notepad++ is:

```

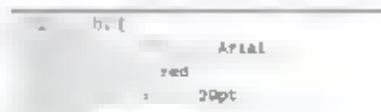
<html>
<head>
    <style>
        h1 {
            color: red;
        }
        p {
            color: blue;
        }
    </style>
</head>
<body>
    <h1>Here is some normal text</h1>
    <p>Here is the text with CSS tags</p>
</body>

```

The output in the preview pane shows:

- The heading "Here is some normal text" is displayed in black.
- The paragraph "Here is the text with CSS tags" is displayed in blue.

- 3 Create another new file and save it as myCSS.css. Enter the following code and then save the file



- 4 Navigate to where the html file is saved using My Computer. Then double click your html file to open in your browser

## 11 PAUSE POINT

Following on from the Step by step complete the following

- 1 In myCSS.css change the font to Wingdings. Save the css file and refresh the html file in the browser
- 2 In myCSS.css change the colour to blue and the size to 100pt. Save the css file and refresh the html file in the browser
- 3 Now that you have done this, save an image from the internet and embed this into your css
- 4 Develop the website to have different alignments of content

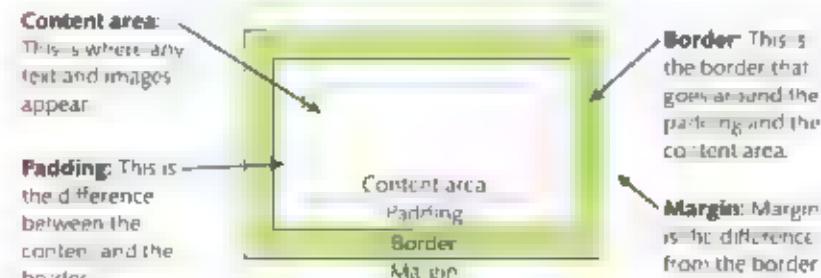
Use the external method of CSS as it is easier to separate the HTML from the CSS. Sometimes, this makes development of your website easier.

Consider how to position your elements on your web page so that this is not restricted to alignments

### CSS box model

CSS is used to create layouts on web pages. Using this method the pages can be viewed in any web browser or at any resolution and the integrity of the design should remain. This is because the layout is recalculated on each opening. The resulting web page can therefore be designed very accurately and can be **pixel perfect**.

The CSS box model structures the web page in a similar way to a table. Margins, borders, padding and content are each defined (see Figure 6.15 for an example).



► Figure 6.15: CSS box model

- Content area - Where the text and images which will be displayed on the web page should be placed. There can be more than one content area on a web page
- Padding - The blank space around the content area which ensures that the content is not displayed right up to the edges of the border.

- **Border** – the design surrounding the padding and content area, which defines the edge of the box
- **Margin** – the blank space around everything so that the box does not display right up to the edges of the screen

The padding, border and margin are optional and if not defined, are set at a default value of zero. At this value they would be invisible.

## HTML

It is important to realise that HTML evolves throughout time and the most current up-to-date version of HTML is HTML5. In HTML5 there are new tags that have been introduced, and some tags that were present in previous versions have been removed.

### Research

Research the differences between HTML 4.0 and HTML5. What are the new tags, which have been brought in, which have been removed and what are the other differences? What do you feel the challenges are of using HTML5?

Table 6.7 describes some common HTML tags, their purpose and examples.

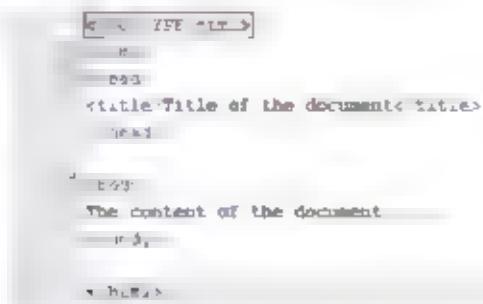
► Table 6.7: Common HTML tags

Open tag	Close tag	Purpose	Example
<strong>	</strong>	Changes text. Open tag can have parameters such as colour, size, face.	<strong>text</strong>
"		Makes text bold.	
<li>	</li>	Makes text italic.	
<ul>		Creates a list with bullet points.	<ul>first item</ul>
<table>	</table>	Creates a table (<tr> creates rows and <td> creates columns).	<table border=1> <tr> <td>top left</td> <td>top right</td> </tr> <tr> <td>bottom left</td> <td>bottom right</td> </tr> </table>
<img>	No close tag	Inserts an image. One of the rare tags that is not in a pair. Creates a hyperlink. Can be used around text or an image.	<img alt="Logo.gif">

## Doc types

The `<!DOCTYPE>` declaration must be the very first thing in your HTML document before the `<html>` tag. This is not an HTML tag, instead it is an instruction to the web browser about what version of HTML the page is written in. When creating a web page you should always add the `<!DOCTYPE>` declaration to your HTML documents so that the browser knows what type of document to expect. When using a rapid application package (RASP) such as Adobe's Dreamweaver, this automatically puts it in for you. When coding a web page using a text editor, you will have to put this in manually.

The most up-to-date doc type is in HTML5 and looks as follows.



```
<!DOCTYPE html>
<html>
<head>
    <title>Title of the document</title>
    <meta>
        <meta name="viewport" content="width=device-width, initial-scale=1.0"/>
        <meta charset="UTF-8"/>
        <meta name="description" content="A simple test page"/>
        <meta name="author" content="John Doe"/>
    </head>
    <body>
        <h1>The content of the document</h1>
        <p>This is a test paragraph.</p>
    </body>
</html>
```

## Client-side scripting

Even though HTML is the basis of all web pages, as a language it is quite limited and so other languages need to be brought in to create more advanced features on web pages. A client-side scripting language is used to write code that is embedded into the HTML. When the web page is downloaded onto the user's browser, the script is run on the user's computer.

### Link

To remind yourself of what client-side scripting is, see Where scripting runs

VBScript<sup>1</sup> and JavaScript<sup>2</sup> are client-side web languages. This means that the code is executed using the user's computer and not the web server. This frees up the processing power which would otherwise have been used on the server. Both languages can create interaction on a website, for example forms, searching and even games. Although VBScript<sup>1</sup> and JavaScript<sup>2</sup> are used to create extra functionality within web pages, they are different and have different uses. VBScript<sup>1</sup> is a simplified version of Visual Basic<sup>3</sup> that Microsoft developed to deal with the static nature of websites. The *drawback* of using VBScript<sup>1</sup> is that it is only supported in Internet Explorer<sup>4</sup>, whereas JavaScript<sup>2</sup> offers cross platform support for most web browsers. Table 6.8 below denotes some of the differences between the two languages.

Table 6.8

JavaScript <sup>2</sup>	VBScript <sup>1</sup>
Tends to be the default scripting language for most web browsers	Not the default language of choice by website developers
Offers cross-platform support for nearly all web browsers	Supports Internet Explorer <sup>4</sup> only
(+) is used for addition as well as concatenation	& is used for concatenation
Case sensitive	Not case sensitive
{ } are used to denote functions	Uses Function and End Function

## Embedding client-side script into a web page

Follow the process that follows to embed original client-side scripts into web pages to provide more interactivity and improve the usability of a website.

## Step by step: Creating a simple catalogue search using JavaScript\*

4 Steps

**1** Using Notepad++ or a RAD tool such as Dreamweaver<sup>®</sup> create a catalogue web page with three products

**2** Below the <body> tag, enter the following code.

```

<HTML>
<head>
</head>
<body>
<script>
  necklace =
  bracelet =
  toy = 3
  product=product
  if (product=="necklace")
  (document.write("You have " + necklace))
  else
  if (product=="bracelet")
  (document.write("You have " + bracelet))
  else
  document.write("You have " + toy)
</script>
</body>
</HTML>

```

**3** Amend your code to match your three products.

**4** Run the web page in a browser to test if it works for all three products. (It needs to be viewed in Windows<sup>®</sup> 10 and the latest version of a popular web browser)

## PAUSE POINT

Client-side scripting can be used to provide different kinds of interactivity for web pages. Using resources such as the internet or books see you can create the following functionality within a web page:

- 1 Place today's date in the header of a web page
- 2 Place the current time in the footer of a web page and make it work in real time
- 3 Using a form text field enable so that when you type in text and press the <Tab> key it will convert the text to uppercase
- 4 Display an alert when someone visits your website
- 5 Create a hit counter



Consider working in pairs to see if you can come up with the correct solution. Website developers often work together to develop solutions to problems.



Try to embed the JavaScript<sup>®</sup> coding into an external file (this is similar to the way in which you would create a CSS external file). Research how this would be done and what advantages it would have.

## Use of scripting languages

A scripting language such as JavaScript® has many uses. Some of the uses of JavaScript® are outlined below.

### Alerts

Pop-ups to alert the user to something.



### Confirming choices

Confirming choices is a form of validation. This gives a user the opportunity to check if they are sure that they clicked the correct option.

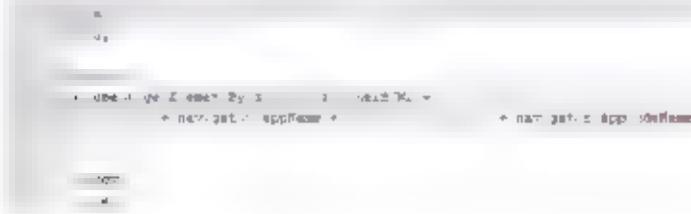


#### Key terms

**Validation** an automatic computer check which ensures that data entered is sensible and reasonable

### Browser detection

Used to determine what browser you are using.



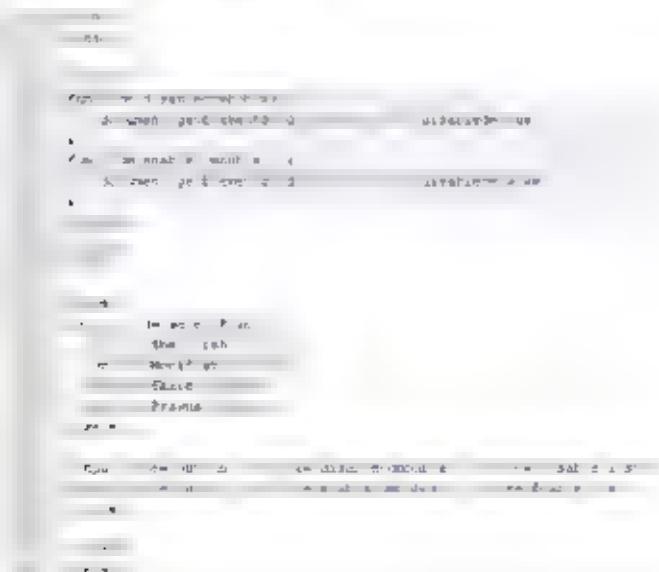
## Creating rollovers

Rollovers add more visual interactivity. A web page can use rollover images or in this case, buttons.



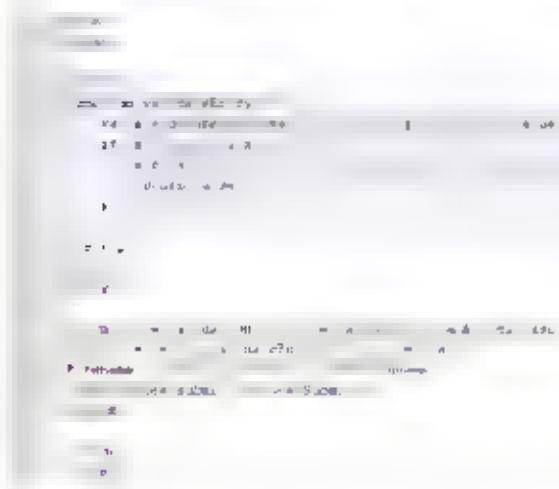
## Handling forms

Handling forms allow users to fill in forms and submit them either for the website to process or by email to an inbox. This example enables a user to disable and enable a drop-down list using JavaScript®.



## Validating input

Validating inputs is a technique used to see if a user has entered text within a textbox. Here is an example:



## Constructs

Constructs are syntactically permissible parts of a program, and must be used in accordance with the rules of the programming language you are using. As with any code scripting languages need to use the correct construction in order to work. This includes the **syntax**. It is important for any programming language that the syntax is correct. In the example below the **dot operator** is used to allow an object to use a method.



### Key terms

**Syntax** - a set of rules that is unique to each programming language which defines the combination of symbols considered to be correctly structured within that language

**Dot operator** - is a full stop(.) used to define what method an object will use

**Array** - a collection of indexed variables, each of which has a single value

Here is a list of various constructs:

- ▶ **Loops** - loops are useful if you want to run the same code repeatedly each time with a different value. Loops can often be used with arrays.
- ▶ **Decision making** - This is the process of using a statement whereby the user is forced to make a choice on a web page. For example, are you sure you want to exit this page? The options being either 'Yes' or 'No'.
- ▶ **Functions** - A function is a block of code designed to perform a particular task. This can be executed when something calls it into action.

```

function myFunction(x) {
    while (x < 6) {
        console.log(x);
        x++;
    }
}

myFunction(5);

```

- ▶ **Parameter passing** Parameter passing occurs when a value is passed to a function and then the function uses it while it is running.
- ▶ **Handling events** Events are 'things' that happen based upon user interaction or something that the browser does. For example:
  - ▶ an HTML web page has finished loading
  - ▶ an HTML input field was changed
  - ▶ an HTML button was clicked
- ▶ **Methods** A method is an action that can be performed by an object. The image below shows how the method toUpperCase is used to force the whole word to be in upper case

### Key term

**Object** an object is a type of data that knows things about itself (its properties) and knows how to do things (methods)

## Other issues involved in website development

Once you have developed your website using client-side scripting languages, there are a few other things you need to consider before your website development will be complete.

### Compatibility with mobile and tablet devices

It is important when you develop a website that you consider how to make your website compatible with mobile and tablet devices. This is called **responsive web design (RWD)**. RWD involves using CSS and HTML5 to resize, hide, shrink, enlarge

or move the content to make it look good on any screen. There are a number of methods of RWD for making a website compatible with mobile and tablet devices.

### Key term

**Responsive web design (RWD)** makes your web pages appear correctly (look good) on all types of device, including desktop PCs, mobile and tablet devices.

## Effective use of tools and techniques

There are many scripting languages such as HTML, JavaScript® CSS and it can be quite overwhelming to use the techniques associated with using them to produce websites. There are additional tools available that can help you to produce websites more easily, for example the rapid application development (RAD) package Adobe® Dreamweaver®. These RAD packages allow you to create websites very quickly. For example, if you wanted to centre some text you would simply highlight the text and click on the central alignment button. The code for this change would automatically be generated for you. This may seem great and more effective to use. However you do have more control over your website when you code it manually using a text editor.

## Uploading of files to a web server

To allow a website to be seen by the public across the internet, it must be uploaded onto a web server (going live). The process of uploading involves a protocol called File Transfer Protocol (FTP). Uploading files via FTP (commonly known as FTPing) can be done directly through a web browser or by using a program such as FileZilla®.

It is not only the web pages that must be uploaded onto the web server, but all the associated files including media assets and CSS files. This is because these files are not embedded into the web pages. Instead, they are linked to them but remain as separate entities.

### Reflect

Working to time and schedule is important when developing a website. Timelines are often defined at the outset of a project. Someone will need to take responsibility for ensuring that all parts of the project are delivered on time. For example, set amounts of time will be given to the requirements stage, the design, the coding, testing and so on. Strong leadership is important to oversee all of these stages. If one of the stages takes too long, or is incorrect, then this has a knock-on effect on the following stages. Therefore it is important, when managing a website project that there is strong leadership and good communication.

## Website review

After your website is built, it is essential to review it to ensure that it is suitable for its intended purpose and audience, and meets all the client's requirements. This can also identify any areas for further improvement.

### Quality in comparison with other similar websites

Once your website has been completed it is useful to compare your website against similarly themed websites. Remember that millions of websites are created daily so you have to do more than your competitors to make your website stand out. Comparing your website against similar websites will enable you to identify areas where your website stands out positively (compares favourably). There may also be elements of other websites that are better than yours or that work particularly well which could be incorporated into your own. You can take ideas from these websites to use for future improvement of your website. You might also identify areas in need of improvement in the other websites. Therefore, when further developing your website, you can use strong features from similar websites and leave out those features which you have identified as in need of improvement. This research will help you to produce a website which will stand up to competition from similar websites.

### Suitability for intended purpose and audience

Your website will need to be reviewed to establish whether or not it is suitable for the purpose and audience for which it was intended. Quite often this will involve carrying out some form of market research to get feedback from potential users and discussions with the client to see if they are satisfied with the overall website. Remember that while you may have been hired to develop a website for your client, ultimately it is other people that will be using it and these are the people that you (as well as the client) need to cater for. It is possible that the client might not fully understand the design preferences of the intended audience of the website, in which case your user feedback may help to inform both you and the client about how the website could be improved.

### Suitability against the client requirements

During the beginning of the website development lifecycle one of the first elements to be generated was a list of requirements. These SMART requirements state what the website must be able to do and how it should work in order to know if the website development has been successful. It is

important to compare the original requirements against the final developed website. There will need to be an appraisal to establish whether or not you have been successful in fulfilling the original requirements. If you find that there are some requirements that have not been fulfilled, then these areas can be optimised and developed further to meet the client requirements fully.

#### Reflect

Taking individual responsibility is a crucial behaviour attribute, whether in the IT industry or any other walk of life. There are always times when we fail to meet expectations. This is human nature and there is nothing wrong with it as long as we take responsibility for our own actions (we are accountable for them). The most important thing is that, when this does happen, a person understands what went wrong and puts measures in place to ensure that it does not happen again.

### Legal and ethical constraints

Your website will need to be reviewed to ensure that it complies with any legal and ethical considerations. For example, it has already been mentioned that websites must be fully accessible. This means that your website must have elements such as:

- ▶ having alternative tags embedded within images
- ▶ having clear navigation
- ▶ ensuring documents/web pages are understandable
- ▶ not using colour alone to provide meaning

Moreover, your website will need to be reviewed to ensure that it does not break current legislative laws, in particular the Data Protection Act 1998 and the Copyright, Designs and Patents Act 1988.

### Strengths and improvements

You may notice that websites evolve and change with the times. Good websites recognise that they have to stay up to date with the latest trends in good design and cater for the needs of all users. Therefore, once your website has been developed, it is important to identify areas of strength and any areas in need of improvement within your website.

Consider a social networking website such as Facebook™ which has millions of registered users. The Facebook™ website has continuously evolved, considering feedback from others and making improvements. As a website developer you will seldom be satisfied with the end product and should always try to find ways of improving and adapting your website.

However, it should be noted that there are limits on the improvements you can make to websites. Web developers cannot always take on board all comments and feedback because they may be constrained by time and budget. Therefore you need to carefully select which improvements can be made. These decisions need to be considered within the website development team and with the client. You should consider which improvements will be of the greatest benefit to the website and which will be most beneficial to the client's business. Other improvements should be set aside for now but be planned as part of future development at a later date.

## Website optimisation

As well as reviewing the website, it is essential that the website is fully tested to ensure that it is fit for purpose and works correctly. There may be elements within the website which do not work as intended and therefore need to be optimised in order to fulfil the client's requirements.

Your website can be optimised so that it runs more quickly and efficiently. The following are ways in which your website can be optimised to run much more effectively:

### ► Reduce HTTP requests

- this can be done by using CSS instead of images, wherever possible
- combine multiple style sheets into one
- reduce scripts that run on the page

### ► Compress large web files

- compression reduces the bandwidth used by your web page, thereby reducing the HTTP response time. There are online tools which enable you to do this.

### ► Avoid WYSIWYG resources

- WYSIWYG (What You See Is What You Get) are website resources that enable you to create a website quickly by inserting website objects, although they

make it easy to build a web page, they do create messy code which can slow down your website considerably.

### ► Optimise Images

- oversized images can take longer to load, so it is best to optimise your images to the required size.

### ► CSS Delivery

- an external style sheet is the best method to optimise a website to its full potential, as only one external stylesheet is required. It reduces the size of your code and creates less code duplication.

These are additional areas of website optimisation that a user can test for and which would increase the performance of your website.

## Performance and user testing

Performance and user testing is perhaps one of the most crucial forms of testing. This is used to test the functionality of a website and to ensure that everything works as expected. It's at this stage that you can use the test plan that was developed during the design stage and extend it to show the actual results and comments.

### Link

Look back at Testing plan and, in particular Table 6.5 Example test plan. You should use your test plan for user testing to show the actual results.

### Tip

Remember to develop your test plan in a landscape orientation. This will give you more room to complete your testing and keep all related information together on one row.

► Table 6.9: Example test plan with results

Test number	Purpose of test	On page	Test data	Expected result	Actual result	Comment/screenshot
1	Test the home button logo.gif	About.htm index.htm	Left click Load page	Load index.htm Appears in the centre of the page	SUCCESS SUCCESS	It worked as expected. No further action required. The logo appeared in the centre of the page as expected. No further action is required.
2	Test the alt attribute tag of logo.gif	index.htm	Left click Load page Hover over logo	Tool text tip appears	Tool text tip appears	On this attempt it worked - failed to put in the speech marks of the alt tag. Now works as expected Screen shot 2
3B						

Remember that your test plan can also be used to check interactivity and compatibility with other web browsers. For example, if you have included any client side scripting, such as including the time and date, then this should be tested. Remember that your website will be viewed in different web browsers. Consequently, the way in which your website may appear in one web browser may not be the same in another. Therefore, you will need to ensure that you complete your test plan in two or three different web browsers. When something does not work as expected, then this should be commented upon in the 'Comments/screenshot' column.

#### Tip

The Snipping Tool in Windows® is really useful for snipping images of your screen to show your screenshots of the website whenever you have a test success or failure. To access it go to the Windows Start screen, click on All apps, scroll down and click on Windows Accessories, then scroll down and click on the Snipping Tool.

### Obtaining and evaluating feedback from others

Testing can take many different forms. As in the design stage, you could develop questionnaires to elicit feedback from others to help you refine your initial designs. You should obtain feedback from potential users of the website, in particular.

It can be hard to be critical about something which you, yourself, have developed. Therefore it is important that, when your website has been developed, you obtain feedback from your client, potential users and peers to see if the website works correctly, whether it meets the client's requirements and whether it is suitable for its intended purpose and audience.

Your initial design questionnaires can be adapted to elicit user feedback about the developed website using quantitative and qualitative questions. The feedback that you get will help you to identify where improvements can be made to your website. Be aware that you need to evaluate the feedback you receive about your website. Hopefully, most of it will be relevant and useful but it is possible that some of it is inappropriate or not helpful. For example, a client might feed back that the website does not have a particular element that was not in the brief.

It is unreasonable and outside the scope of the website requirements for them to request this feature at this late stage. However, you may need to consider developing this feature if the client is willing to wait for the website and to pay for additional features.

#### Theory into practice

When asking your client and potential users for feedback on your website, it is likely that not all of the feedback will be positive. As an IT professional, it is necessary to have a 'thick skin' while also remaining objective and being professional. Remember that within the computing industry reputation is very important. Therefore, understanding how to respond to outcomes and how to communicate effectively are key attributes of a website developer.

Once your website has been completed, you will need to present and launch the website that you have developed. You will need to provide clear and comprehensive feedback on the product and show how it fulfils the original requirements that were defined in the design stage.

- 1 Consider how you will be positive in the face of negative criticisms of your website. List three things that you would do to deal with negative feedback in a constructive way.
- 2 Consider how you will effectively present your completed website to the client. Summarise what tools you will use to present your website and what you will include in the presentation.

#### Reflect

Once the website development has been completed you will need to provide a justification and rationale of the decisions made. It is important that when doing this you refer back to the original requirements and the design documentation. By carrying out an evaluation of the outcome of your work, you can convey to the client that a high quality product has been developed because you are able to justify your decisions based on all the processes that have been undertaken.

Carry out an evaluation of your website development outcomes.

**Assessment practice 6.2**

BP2 ◉ BP3 ◉ CP4 ◉ CP5 ◉ CP6 ◉ BM2 ◉ BC.D2 ◉ CM3 ◉ BC.D2 ◉ BC.D3

You were successful in the first part of your interview. The recruitment manager was very impressed by your report on the principles of website design. As a result, you have been placed on probation and given a twelve week trial, where you have been asked to work on a website project.

You will be responsible for the design, development and testing of the website. It is hoped that, if you do a satisfactory job, the recruitment manager will authorise you to pass your probation and provide you with a full-time job.

**Design stage**

Your client is a local county council who want a website to advertise a town. The website that you produce will be used to promote the area and improve tourism. Therefore you will need to highlight the positive aspects of the town so as to attract visitors to the website.

A set of client requirements will be provided. You will need to produce design documentation including mood boards, storyboards, wireframes and flowcharts (to show any client-side scripting). You will work with a peer to review your designs and identify any areas in need of improvement. You will need to document the review that your peer completes for you so you will need to develop a questionnaire which you can give to them to elicit their feedback. It is important that the questionnaires ask a variety of questions so as to highlight areas of strength in the designs and identify those areas in need of improvement.

Be sure to include a completed test plan which you can use to test your developed website. This will need to be populated with a minimum of 20 tests.

After your designs have been reviewed and any improvements made, you will need to fully evaluate the design and justify the decisions that you made, explaining how it would meet the needs of the client.

**Development stage**

Using your design documentation, you are to produce a website which will fulfil the client requirements. As you develop your website, make sure that you test it as you go along. Be sure to use the test plan that you completed.

Once you have completed your website, review it by getting your peers to critique it. Therefore, you need to use questionnaires to gauge their thoughts and opinions. Be sure to optimise your website based on their feedback, by making the changes that they suggest (assuming they are good ideas). It is recommended that you keep before and after versions, annotating where the changes have taken place.

Finally, you should evaluate both the design and the final website that has been developed. This will mean looking at the overall process undertaken and identifying what went well and what did not go so well.

Throughout the whole process, you will also need to demonstrate individual responsibility, creativity and effective self-management. This is important, as the recruitment manager is eager to know that you have the necessary traits of being able to work responsibly, professionally and under pressure to fulfil the role of a web developer.

**Plan**

- What is the task? What am I being asked to do?
- How confident do I feel in my own abilities to complete this task?
- Are there any areas I think I may struggle with?

**Do**

- Have I spent some time planning my approach to the task?
- Am I confident that I know what I am doing and that I know what it is I should be achieving?

**Review**

- I can explain what the task was and how I approached it.
- I can explain how I would approach the hard elements differently next time (ie what I would do differently).

### Further reading and resources

- Flanagan, D. (2011). *JavaScript: The Definitive Guide (Definitive Guides)*, Sixth Edition. Cambridge: O'Reilly Media.
- McFarland, D. (2015). *CSS: The Missing Manual*, Fourth Edition. Cambridge: O'Reilly Media.
- McGrath, M. (2011). *HTML5 in Easy Steps*, Seventh Edition. Southam: In Easy Steps Limited.

### Websites

[www.csszengarden.com/](http://www.csszengarden.com/)

This website allows anyone to explore different CSS templates which can be applied to a website design.

[www.webpagesthatsuck.com/](http://www.webpagesthatsuck.com/)

This website analyses well and poorly designed websites.

<https://validator.w3.org/>

The Markup Validation Service (W3C) allows you to validate website content for free. This website enables you to check for errors and ensure that your website is W3C compliant.

[www.codecademy.com/](http://www.codecademy.com/)

Includes free videos and training tutorials on how to develop websites.

[www.w3schools.com/](http://www.w3schools.com/)

A useful starting point for anyone who wishes to learn how to use HTML, CSS and JavaScript to produce websites.

# THINK ► FUTURE



**Michael Bean**  
Junior Website  
Developer

I've been working as a website developer for over three years now. I was fortunate to take an apprenticeship position with a company that hired me to learn on the job while I undertook my BTEC National in IT. The experience I gained while working at college and in the workplace has been invaluable. I was so pleased to become a full-time employee with the company I am at, as it gives me opportunities to develop my creative and artistic skills when creating websites. As well as this, there is a challenging, problem-solving side to the job where I have to develop solutions to problems that occur. Sometimes, these problems can be quite simple to solve. Other times they need more thought but, as I am working within a team, there are people I can talk to, and together the problems quickly develop into solutions.

If there is one thing I would like to pass on to aspiring web developers it would be to always remember to place the needs of the client first. If the final website does not suit their requirements or does not fit the audience, then the client is within their rights to reject it. The client's needs must be balanced with the users' needs too. The client needs a website that people will want to visit, which draws them in and grabs their attention. Balancing these needs can be challenging, at the best of times. However, when you develop a website from the very beginning to its completion, it is a very satisfying achievement, and one which gives me pride in what I have done.

## Focusing your skills

### Designing a website

It is important to be able to design a website before you go ahead and actually develop it.

- What are the main methods in gathering feedback from your client?
- What are the implications if you fail to gather the requirements for the website?
- As a website developer, you are put under constraints. What might these constraints be? And what effect could they have on the development of the website?
- Finally, once you have gathered all the requirements, what design methods should you employ? To whom should these designs be presented?

### Creating a website

Once you have received all necessary feedback and the design stage is complete, you can go ahead with developing your website.

- What would you consider to be the best method of developing a website? Would you use a rapid application development package such as Dreamweaver® or would you use a text editor?
- If your testing revealed that your home page does not look right or render properly in another web browser, what steps would you take to resolve this issue?
- What steps should you take if your client does not like the initial look of the website?
- How would you upload the final website to the worldwide web?

## Getting ready for assessment



Kelvin is working towards a BTEC National in IT. He was given an assignment with the following title: 'How website principles are utilised to create effective websites' for learning aim A. As part of this assignment, he was provided with a real-life scenario which he may encounter when he attends interviews for the role of a website developer. The assignment is based on a Word® report explaining how two websites utilise website development principles. Kelvin will also need to:

- ▶ give an explanation of how the principles embedded within his chosen websites meet the client requirements
- ▶ give a comprehensive evaluation of how website principles incorporated within his chosen websites have been utilised to create a creative, high performance website.

*Kelvin shares his experience below.*

### How I got started

First I collected all my notes on this topic and collated them into a folder, for easy reference. My first task was to select two websites which I could compare. This proved more challenging than I expected because I wanted to select a website which included the majority of the elements that I had learnt about in my lessons.

Once I had selected the websites, I printed out screenshots of the web pages onto paper. I began to highlight areas where website principles had been incorporated. This helped me enormously when I began to bring it all together to produce my assignment. I also highlighted areas where website principles were not incorporated appropriately. I made brief notes, in the margin, of the implications this could have on website visitors.

### How I brought it all together

I decided to use Microsoft® Word® and to use a sans serif font such as Arial. I had learnt that sans serif fonts are easier to read, especially for people with learning difficulties such as dyslexia. I wrote a short introduction, identifying the two websites I was going to discuss in my report.

- ▶ I produced a screenshot of the home page of each website.
- ▶ I produced screen grabs of the elements of the web page where I wanted to give further explanation and analysis. I found that the Snipping Tool in the All apps, Windows Accessories section of the Start menu really helped me extract elements of the websites easily.
- ▶ I explained how each of the websites was suitable for their intended audience and purpose.

- ▶ I gave an evaluation of how website principles contributed to creating two websites which were highly effective and creative.

I ended with a brief conclusion giving my overall thoughts on the websites. This helped to summarise my findings.

### What I learnt from the experience

I found the task more challenging than I initially thought it would be. I began to research websites which gave me full coverage of all the principles I had learnt about in lessons. I did spend too much time on this, and this meant that I had less time to complete the report. This meant that my evaluation was not as detailed as I would have liked. I feel that the report would have benefited from having more detail about the way in which website principles are used to create high performing websites.

I also chose two differently themed websites. With hindsight, I think it would have been better to choose two similarly themed websites. If I had chosen two similarly themed websites I believe comparing them would have been easier and would have felt more natural than comparing two completely different websites. I would also consider that both of the websites did not need to be great, as then there would have been more to compare about them.

### Think about it

- ▶ Have you written a plan with timings so you can complete your assignment by the agreed submission date?
- ▶ Do you have notes on all the elements of website principles that you have been taught?
- ▶ Have you included screenshots to give extra clarification to any justifications you have given?
- ▶ Is your information written in your own words with quotations from books, journals and websites and is it referenced clearly?